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IT'S PERSONAL

A NOTE ON THIS ISSUE:

Welcome to the July issue of MPT! A continuous and reliable source of hot water is a modern necessity, but in this month's Case Studies section, we take a tour outside our usual domain of processing plants, municipal facilities, and manufacturing operations. James Facer of Noritz America shares how his company's tankless water heaters ensure unfailing hot water supply the Oahu Community Correctional Center (pg. 14). But don't worry, we're only visiting.

Representing nearly a quarter of the global energy mix, natural gas plays an important role in meeting worldwide energy needs, and gas producers require accurate real-time measurement of the composition of liquid natural gas. In this month's Maintenance & Reliability section, MarqMetrix's Marc Malone shows how his company's Raman spectroscopy system offers efficiency and accuracy during LNG processing and custody transfer (pg. 24).

In our Motor Solutions section, Ken Kelly of Force Control Industries introduces how his company's motor brakes employ oil shear technology, providing a longer service life with no maintenance or adjustment in demanding palletizer applications (pg. 42). Enjoy!



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Modern Pumping Today

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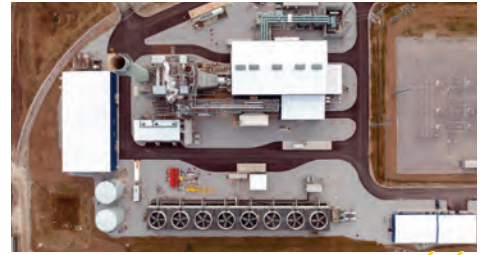
Featured Product: Blacoh Industries 50

Surge Transient Pressure Monitoring

EFFICIENCY POINT

There's no such thing as "waste" water, only wasted water 52

The WaterReuse Association's Pat Sinicropi says, for recycled water, the future is now



10



24



42



46



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ENOSIX RELEASES PLAN FOR GROWTH AND MARKET EXPANSION

Enosix Inc., a prepackaged data integration solution for SAP that seamlessly connects salesforce cloud solutions, announces that hyper-growth veteran sales executive Jeff Benson will be joining Enosix in the capacity of vice president of sales to lead Enosix through growth stage.

"I immediately recognized the tremendous opportunity that enosix has in the market, not only with SAP, but to extend their SAP API framework to support additional front-end business applications, and the broader data integration market," Benson explains. "With growing customer demands, SAP customers are challenged by the complexities of integration, and this disconnect is significantly impacting customer experience. Enosix with Salesforce Cloud integration, among other iPaaS and front-end integrations, affords SAP customers the agility, accuracy and speed to meet customer and distributor demands critical for competitive advantage."

Enosix CEO Nick Fera celebrates Benson as a critical strategic role for the organization. "I'm excited to welcome Jeff Benson to the Enosix management team. Jeff's extensive sales leadership and years of experience selling into organizations utilizing SAP ERP solutions is a perfect fit."

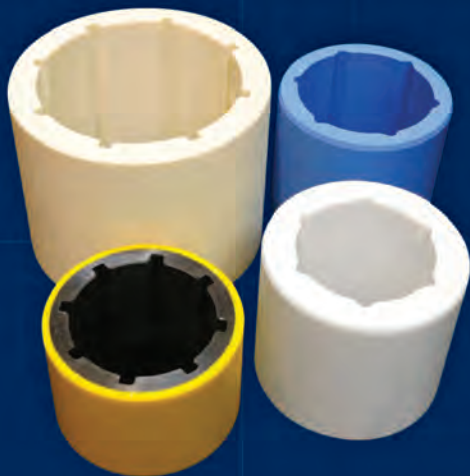
EMERSON ENTERS INTO AGREEMENT WITH JOTUN TO AUTOMATE GLOBAL MANUFACTURING PLANTS

Emerson announces a framework agreement with paint manufacturer Jotun to automate and digitalize its global manufacturing facilities. The five-year agreement will enable Jotun to implement Emerson's digital technologies to enhance all aspects of manufacturing automation in new factories, and for selected upgrades in some of its thirty-nine existing factories around the world.

Jotun is one of the world's leading manufacturers of decorative paints and marine, protective, and powder coatings. Through its agreement with Emerson, Jotun will increase process automation and create a standardized digital technology solution for new factory projects, which will help the company achieve increased throughput, uptime, and product quality, while reducing operating costs.

"In securing a long-term automation partner with the expertise required to support our journey, we will have access to systems, competence, and support serving our needs when constructing and operating technically advanced and efficient paint factories around the world," adds Fredrik Urdahl, Jotun's group technical director of operations. "Emerson's advanced automation technologies and focus on providing standardized project methodologies, as well as global

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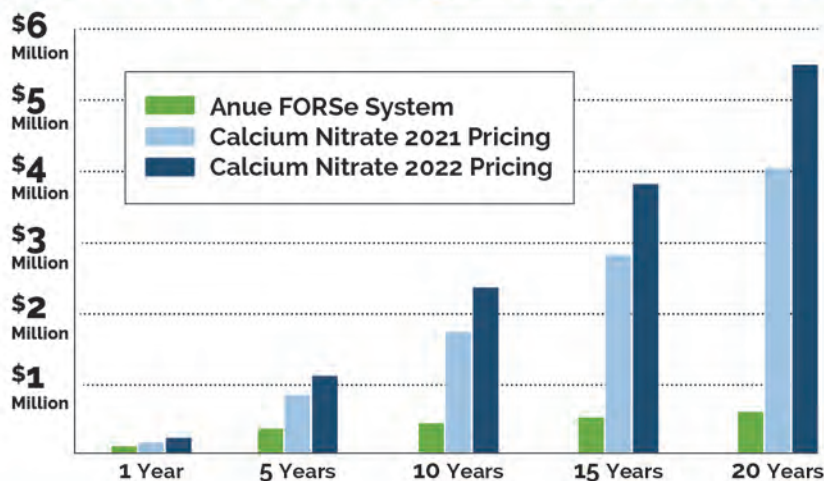
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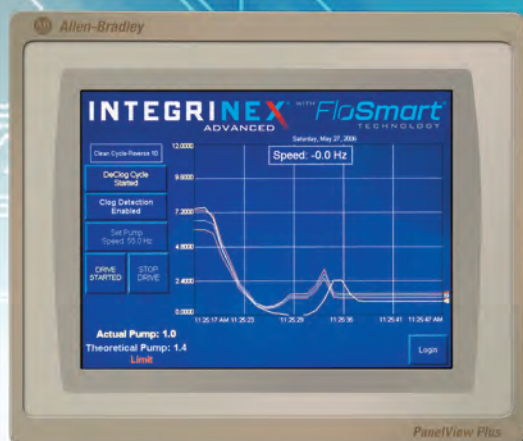
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*GE HA gas turbine provides progress toward a
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BY ADAM TUCKER, GE GAS POWER, AND JOSH MARTINCIC, LONG RIDGE ENERGY

Long Ridge Energy Terminal began commercial operation in October 2021 in the scenic town of Hannibal, Ohio with ambitions of being a forward-looking and innovation addition to the power grid. Recently, the plant conducted a successful demonstration using a hydrogen-blended fuel in GE's HA gas turbine at Long Ridge's 485-megawatt combined-cycle power plant. The hydrogen blending test was completed on March 30 of this year at the facility using hydrogen produced as by-product from a nearby industrial facility.

GE and Long Ridge Energy, which is a subsidiary unit of Fortress Transportation and Infrastructure Investors and an affiliate managed by GCM Grosvenor, see this as a successful first step to transition Long Ridge's power plant toward carbon-free hydrogen.

A PROFOUND ACHIEVEMENT

"This is a profound achievement for Long Ridge Energy Terminal, GE,

and the entire power generation industry. Our Hannibal power plant is the first GE H-class plant worldwide in commercial operation to blend hydrogen successfully and we will continue to work with GE to lead the deployment of utility-scale hydrogen solutions and sustainable energy storage," says Bo Wholey, president of Long Ridge Energy Terminal.

"We are focused on delivering low-carbon, reliable, and cost-effective energy to our customers including local data centers and technology companies. Data centers represent one of the many industries that can benefit from hydrogen-fueled power generation and—supported by GE's advanced gas turbine—we are committed to meeting these needs."

THE CARBON-FREE TRANSITION BEGINS

The plant is powered by a GE 7HA.02 gas turbine, which can burn between 15 to 20 percent hydrogen by volume in the gas stream initially and is

PROJECT IN BRIEF

- Demonstration signifies first time a GE H-Class "utility-scale" gas turbine is utilizing hydrogen in a commercially operating power plant worldwide.
- Project is major step in Long Ridge Energy Terminal's plans to generate carbon-free electricity by transitioning their natural gas plant to run on hydrogen over time
- Project achieved the successful start of commercial operation in 2021 and demonstrated hydrogen fuel blending successfully in March 2022

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For more information, visit www.longridgeenergy.com.

expected to have the capability to utilize up to 100 percent hydrogen over time. For the demonstration, GE provided an integrated system—GE's H₂ Integrated Fuel Blending System—to allow an initial blending of 5 percent hydrogen by volume and natural gas to demonstrate the capability. The blended fuel was injected to the combustion system of the gas turbine, and further upgrades will allow the power plant to utilize higher percentages of hydrogen subject to fuel availability and economics.

"Gas turbines—whether new or retrofitted—can help the power generation industry reduce its carbon emissions this decade by blending hydrogen with natural gas, and this first-of-its-kind demonstration in a H-Class "utility-scale" gas turbine is a major milestone for GE's and the industry's journey towards lower-carbon power generation," says Scott



Strazik, CEO of GE's Global Energy Business Portfolio.

"This milestone is built on a great legacy of hydrogen fuels experience across GE's non-HA gas turbine fleets where GE has more than eight million operating hours burning hydrogen or similar low-carbon fuels. We are pleased to collaborate with Long Ridge to demonstrate pre-combustion decarbonization is



something we can and must pursue today, even on GE's largest utility scale HA gas turbines, to demonstrate that gas generation can be a destination technology in the energy transition."

THE FUTURE AWAITS

The facility plans to produce hydrogen onsite and is considering the use of below-ground salt

formations for large-scale hydrogen storage. In this way, the plant will be able to support a balanced and diverse power generation portfolio in the future and leverage an overall energy storage capability ranging from accommodating seasonal fluctuations related to renewable power to cost effective, dispatchable intermediate, and baseload power. ■

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TANKLESS WATER HEATERS ENSURE UNFAILING HOT WATER SUPPLY



For the Oahu Community Correctional Center, new technology provides a reliable solution

BY JAMES FACER, NORITZ AMERICA



After replacing aging boilers with multiple Noritz tankless water heaters, administrators at Hawaii's Oahu Community Correctional Center were able to safeguard reliable hot water supplies for its 1,200 inmates.

A continuous and reliable source of hot water is a modern necessity, especially for certain commercial installations such as restaurants, hospitals, laundries and some manufacturing operations. Another application that requires a reliable hot water supply are correctional facilities, which have cooking and laundry operations, as well as inmate hygiene use. Officials at the Oahu Community Correctional Center (OCCC) in suburban Honolulu, realized this firsthand when two twenty-three-year-old 1,000,000 BTU boilers and two 500-gallon storage tanks reached a breaking point, jeopardizing operations.

"The last thing we want is to endanger staff safety because the facility does not have sufficient hot water," warns Terry Visperas, program specialist with the Hawaii Department of Public Safety. This critical need prompted Visperas to work with facility maintenance staff and the state's gas utility, Hawaii Gas, on a solution that became more urgent when the center's second boiler failed.

PUBLIC HEALTH AND SAFETY ISSUE

"From a public health and safety perspective, reliable hot water is an essential component of this facility's operation," explains Visperas, who

PROJECT: Oahu Community Correctional Center	EXISTING: Twenty-three-year- old 1,000,000 BTU boilers and two storage tanks	NEW: 18 NCC199CDV gas-fired commercial condensing tankless heaters	PERCENT CHANGES
BTU Input	2M	3.6M	+80%
Storage	1,000 gallons	N/A	
Uniform Energy Factor	0.62	0.96	+34%
GPM Recovery	35.4	100.7	+184%
Total BTUh Recovery	2.48M	3.59M	+45%
Operational Redundancy	2x	15x	+13x
Turn Down Ratio	4:1	198:1	
Installation	Aerial crane	Skid-mounted /Hand dolly	

specializes in researching and integrating renewable and emerging technologies for the department. “Bad things happen when necessary systems don’t work as expected.”

Together, representatives from Hawaii Gas and OCCC facility staff devised a plan to replace the two aging boilers with multiple commercial condensing tankless water heaters to provide continuous hot water at the correctional facility.

To prevent a critical failure, the team leveraged the plug-and-play operation of a prefabricated multi-tankless commercial heater system from Noritz America. Shipped as a complete wall- or floor-mounted module, contractors can select from among thirty-six metal rack-mounted systems that are fully assembled with high efficiency condensing tankless heaters, system controllers and manifolds. Installers need only hours to connect water, gas, and build vent runs, rather than days to construct a multi-unit system from scratch.

The initial plan involved installing six NCC199CDV gas-fired commercial condensing tankless heaters to improve the resiliency and reliability of the correctional facility’s hot water supply, according to Brian Yee, manager, strategic partnerships





and new business development for Hawaii Gas.

"With a Uniform Energy Factor of 0.96 efficiency rating, these 199,900 BTUs-per-hour natural gas tankless units produce an endless supply of hot water using renewable fuel that is—depending on its source—either carbon negative or carbon neutral," says Yee, who helped the department plan the retrofit project on behalf of the utility.

TANKLESS BRINGS REDUNDANCY, EFFICIENCY, AND COST SAVINGS

Yee worked closely with Lewis Kam and Ray Gonzalez, both maintenance supervisors at the OCCC, to plan the twelve-week project that would be implemented in three stages to accommodate the 24/7 secure operation. Because the existing boilers and hot water storage tanks were failing, the first and second phases were expedited to avoid catastrophic failure.

Originally designed for 628 detainees, the OCCC facility was rebuilt and expanded more than forty years ago to accommodate 954 detainees awaiting trial and inmates with short sentences. During the summer of 2018, the facility had a population of more than 1,222 offenders, roughly 28 percent beyond the center's capacity.

According to Gonzalez, in addition to more users requiring hot water, most inmates shower at the same time, generating a huge surge in demand. "The existing boilers were installed in 1996 and designed to service a much smaller population than we have today," continues Gonzalez. "Inmates housed furthest from the boilers were most likely to be forced to take cold showers."

The first phase of the retrofit project—with six condensing tankless units—would provide potable hot water to one-third of the center's housing modules, which accommodate roughly 400 inmates. Once complete, the second phase of the project would provide hot water to

the remaining 800 inmates, by adding two prefabricated water heater banks (twelve units) to replace the failing boilers and storage tanks.

The last phase would provide twelve more tankless units to recharge an existing 500-gallon storage tank that serviced the center's laundry and kitchen operation. This option ensured unlimited hot water supplies by increasing system redundancy by a factor of 15.

THE TANKLESS ADVANTAGE

Manufactured by Noritz America, all of the tankless units at the Oahu Community Correctional Center are Model NCC199CDV units that have a maximum flow rate of 11.1 gallons per minute and gas consumption from 18,000 to 199,900 BTUs per hour. The heaters offer an 11:1 turn down ratio and 0.96 UEF Uniform Energy Factor, the newest measure of water heater overall efficiency. The stronger UEF would boost efficiency 34 percent above the previous heaters. The higher

turn down ratio offered additional heating levels; so where the existing boiler could only operate at 500,000 or 1,000,000 BTUs, the new tankless units could incrementally raise output across eleven heating levels to better meet demand. The higher the UEF value, the more efficiently a unit converts energy into heat.

"Gas is a critical fuel for Hawaii's resiliency in emergencies and severe weather events, and we have made preparations statewide to keep our customers supplied with natural gas," says Yee. "In fact, we haven't lost service delivery to our customers since the Pearl Harbor Attack in 1941."

The team then outlined their plan with contractor Mason Hasegawa, with Honolulu-based Mason's Plumbing Service, who estimates he installs tankless heaters twice as frequently as conventional storage tank-type heaters.

"Using tankless heaters for this project was two or three times less expensive and about 100 times easier

than adding a new replacement boiler and storage tank," explains the forty-seven-year plumbing-industry veteran. "A new boiler would take weeks to install, cost more to operate, and still offer only 0.70-0.87 UEF; compared with a 0.96 UEF rate provided by the tankless solution."

The move to tankless also improved the facility's potential hot water output, with a 184 percent increase in gallon-per-minute recover rates.

Both Hasegawa and Gonzalez were pleased with the team's decision to install multiple tankless units, as this approach will offer a level of operational redundancy that was not previously possible.

"You see a lot of commercial and institutional applications with one or two boilers feeding storage tanks, whose total storage capacity roughly matches the peak demand of the project," explains Gonzalez. "As a result, if one goes down, the operation doesn't have enough hot water."

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"A multi-unit tankless job frequently involves three or more units, so each water heater contributes a smaller share of the overall demand," he continues. "If one or even two must be valved-off for maintenance, the remaining units can activate and offset the loss in output, bringing supply much closer to maximum building demand."

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Unit redundancy was very important to ensure sufficient hot water, says Yee, who notes that Hawaii Gas supplies the OCCC with renewable natural gas that is blended with locally produced natural gas for the heaters, which can operate on either fuel type.

"From a utility perspective, we want to ensure detainees are provided with their basic human needs, and the folks who work in these facilities have the highest level of safety standards possible," notes Yee.

Unlike traditional storage water heaters, tankless water heaters use a powerful burner and heat exchanger design to quickly heat incoming water to the set point temperature. They activate only when a fixture is turned on and cease heating once it is off. This ensures energy efficiency because the on-demand heaters are not constantly heating stored water.

Hasegawa installed the first phase of six tankless heaters that were wall-mounted, while phases two and three required a total of four floor-mounted rack units, each configured with six heaters, installed by Oahu-based Economy Plumbing.

The rack units used the same Noritz heaters as phase one, but the project team ordered the remaining modules as a fully-assembled system, designed to speed installation. The prefabricated commercial water heating system combines commercial-grade tankless units with system controllers, manifolds, and other necessary components and

accessories into a fully assembled metal rack system that can be shipped anywhere in North America.

Especially appealing for Gonzalez is the multi-unit system controller, which stages individual heaters on and off based on hot water demand, as well as rotates their operation to ensure even usage.

The goal of the commercial water heating system is to reduce installation time and expense while maximizing performance and reliability when building multi-unit tankless systems. According to Gonzalez, the rack system brings installation as close to "plug-and-play" as possible for plumbing contractors.

All three applications have been meeting hot-water demands since the installations. For his part, Gonzalez is extremely pleased with choosing tankless water heaters.

"They are very good products that eliminate the need for bulky storage tanks, simplify maintenance, and significantly reduce operating costs," he concludes. ■

JAMES FACER serves as national account manager—commercial for Noritz America. He may be reached at 714.433.2905 ext. 7812. Noritz America Corporation, a subsidiary of Noritz Japan, has corporate offices in Fountain Valley, California, and Atlanta, Georgia, offering a full line of tankless water heaters to meet the hot water demands of residential and commercial applications. Noritz supports its products with a national network of skilled representatives and employees who are committed to providing the finest products and services to its communities by helping consumers live in a more comfortable, efficient, and healthy lifestyle. For more information, call 877.986.6748 or visit www.noritz.com.





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THE WHAT AND WHY OF SURGE TRANSIENTS

If water hammer affects production, it's time for AFT Impulse 9

BY REINALDO PINTO, APPLIED FLOW TECHNOLOGY

With an expanded knowledge base and tools like Impulse 9, AFT hopes pipe systems can avoid potentially catastrophic effects of water hammer.

One of the toughest aspects of hydraulic system design is accepting that a system cannot always operate at steady state. Whether system transients are intentional or unintentional, routine or emergency, understanding a transient's impact on a system is critical to ensuring safe, continuous operation.

Applied Flow Technology has released AFT Impulse™ 9 for engineering teams to better understand their systems during deviations from steady state.

WATER HAMMER AND SURGE ANALYSIS

Water hammer and surge analysis performed in AFT Impulse helps engineers around the world mitigate failures and avoid downtime by providing the reliable information necessary to prevent incidents before

they happen. While new features and capabilities strengthen this analysis software with each new version, AFT Impulse has been a premier and reliable transient analysis tool since its release in 1997.

New features in AFT Impulse 9 include the following:

- A redesigned gas accumulator window to improve usability and add new features such as calculating liquid height.
- Improved multi-scenario graphing to compare and animate design alternatives with different time steps.
- Options to convert shear rheometer data for power law and Bingham plastic viscosity models.
- The Herschel-Bulkley viscosity model for shear thinning or thickening fluids with a yield stress.
- A streamlined setup from the new Analysis Setup menu, a user-friendly workflow condensing several model-wide specification windows into one.
- An overhauled Library Manager (previously the Database Manager) offering a consolidated way to access and customize libraries of fluids, pipe materials, components, and more.
- Color-coded, organized, and prioritized list for warnings, errors, and design alerts shown in the output for quick review.

Often water hammer issues are addressed only by specialist consulting companies due to water hammer's esoteric nature, but AFT Impulse continues to be developed with the everyday engineer in mind. Not only will an engineer understand the cause of a problem with AFT's

visualization tools, but they can also design, test, and implement their solution.

AFT Impulse is a powerful dynamic simulation and analysis software used to calculate pressure surge transients in liquid piping systems caused by water hammer, easily modeling a wide range of system components and surge devices. Key to the system's efficacy is its ability to understand the transient response of your system, knowing how valves, pumps, and other components will dynamically interact with each other. This allows technicians to evaluate the effect of pressure surges due to vapor cavity collapse by modeling vapor cavitation and liquid column separation, validating the design of safety features to produce safer, more economical pipe systems.

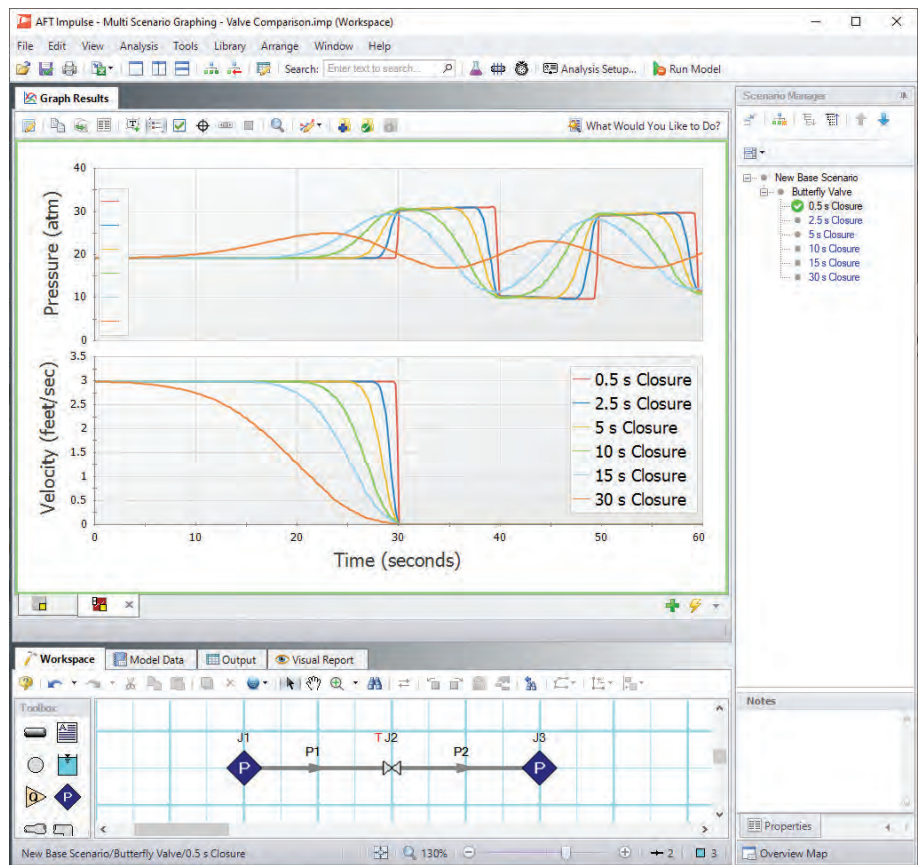
WATER HAMMER EDUCATION AND RESOURCES

Engineers accumulate a lot of knowledge over their career about how to solve very particular problems. Often a concern with water hammer and surge analysis is where to start, especially since rapid transient events are not covered in a typical undergraduate (or even graduate) fluids course. In the past few years, AFT has noticed greater interest in water hammer from engineers hoping to understand this complex phenomenon. AFT has developed materials to meet this interest, not only for advanced topics like identifying and mitigating water hammer by modeling in software, but also introductory fundamentals and theory to help engineers understand the what and why of water hammer analysis.

HELP SPREAD THE WORD

Engineers of all experience levels looking to expand their water hammer knowledge are welcome to join AFT in several ways:

- View free educational webinars or watch recorded webinars available on the AFT website.



AFT Impulse 9 model featuring the multi-comparison graphing feature.

- Subscribe to Water Hammer Wednesdays, a monthly email dedicated to delivering basic water hammer knowledge and upcoming events.
- Visit www.waterhammer.com for educational articles, videos, and resources. This site has something for all experience levels, from physics foundations to mitigation options and everything in between. Contact AFT if you would like to help provide content and resources.
- Join AFT as a member of the Hydraulic Institute's Water Hammer Committee, focused on water hammer awareness and its impact on pumps and piping systems. Visit www.pumps.org for more information.

With an expanded knowledge base and tools like Impulse 9, AFT hopes pump users can avoid potentially catastrophic effects of water hammer

and other undesirable system transients, prevent transient pressure issues by properly sizing and locating surge equipment—such as surge tanks, gas accumulators, and relief valves—and initiate transients based on time or events in the system. ■

Founded in 1993, Applied Flow Technology is a leader in the pipe flow modeling software market. With a primary focus on developing high-quality fluid flow analysis software, AFT's comprehensive line of products for the analysis and design of piping and ducting systems is used in more than eighty countries to engineer safer, more efficient systems and solve operational problems. Learn more at www.aft.com.



FOR ENERGY COMPANIES, TAGGING REGULATIONS REQUIRE A NEW APPROACH

XBRL tagging for FERC vs. the SEC, what's the difference?

BY PERCY HUNG AND PETER LARISON, WORKIVA

Energy companies will soon start reporting quarterly and annual financial and operational data in XBRL format to the Federal Energy Regulatory Commission (FERC). The XBRL format isn't new for public companies that have been submitting reports with XBRL tags to the Securities and Exchange Commission (SEC) for years, but the taxonomy for tagging FERC forms will be different.

TIME TO EVALUATE YOUR OPTIONS

In many respects, the burden should be lighter for FERC filers than SEC filers. Both will rely on the XBRL 2.1 Specification (which defines

the basic building blocks of XBRL implementation in business reporting) and the Arelle open-source XBRL validation engine. And a "fact" in both reports is represented by a value (numeric or non-numeric), elements, date, unit, and accuracy.

But, as we detail below, you'll notice quite a few differences with FERC's XBRL requirements.

SIMPLIFIED ELEMENT SELECTION

Standard schedules allow for highly prescriptive tag assignments. That means no more tagging from scratch. For example, the Workiva solution for FERC reporting provides users with pre-tagged forms. These standardized pre-tagged forms not only reduce

preparation efforts significantly, they also minimize tagging inconsistencies—you can achieve higher data quality with less effort.

Also, you are not required to tag every number. Notes to financial statements require block tags only. For example, if disclosure notes are pasted into FERC Form 1 from the 10-K you file with the SEC, those would be tagged with a single text block for FERC. A bonus for users of the Workiva solution for SEC reporting and the Workiva solution for FERC reporting: You will be able to link information in your 10-K to your pre-tagged Form 1 for consistency and efficiency.

If no applicable XBRL concept is available, the information is not to

Line No.	Title of Account	Ref. Page No.	Current Year End of Quarter/Year Balance	Prior Year End Balance 12/31
(a)	(b)	(c)	(d)	
UTILITY PLANT				
2	Utility Plant (101-106, 114)	200-201	1,186,069,580	1,138,490,390
3	Construction Work in Progress (107)	200-201	54,869,287	32,186,367
4	TOTAL Utility Plant (Enter Total of lines 2 and 3)		1,240,938,873	1,170,676,757
5	(Less) Accum. Prov. for Depr. Amort. Depl. (108, 110, 111, 115)	200-201	384,919,675	368,755,872
6	Net Utility Plant (Enter Total of line 4 less 5)		856,019,198	801,920,885
7	Nuclear Fuel in Process of Ref., Conv., Enrich., and Fab. (120.1)	202-203	0	0
8	Nuclear Fuel Materials and Assemblies-Stock Account (120.2)		0	0
9	Nuclear Fuel Assemblies in Reactor (120.3)		0	8,380
10	Spent Nuclear Fuel (120.4)		0	8,380
11	Nuclear Fuel Under Capital Lease (120.6)		4,841,221	4,725,304
12	(Less) Accum. Prov. for Amort. of Nuci. Fuel Assemblies (120.5)	202-203	5,091,221	4,725,304
13	Net Nuclear Fuel (Enter Total of line 7-11 less 12)		4,841,228	4,733,684
14	Net Utility Plant (Enter Total of lines 6 and 13)		0	0
15	Utility Plant Adjustments (116)		0	0
16	Gas Stored Underground - Noncurrent (117)		511,140	0
OTHER PROPERTY AND INVESTMENTS				
18	Nonutility Property (121)		0	0
19	(Less) Accum. Prov. for Depr. and Amort. (122)		0	0
20	Investments in Associated Companies (123)		0	0
21	Investment in Subsidiary Companies (123.1)	224-225		
22	(For Cost of Account 123.1, See Footnote Page 224, line 42)			
23	Noncurrent Portion of Allowances	228-229	0	0
24	Other Investments (124)		0	0

be tagged. However, if an applicable concept exists, FERC requires the information to be tagged (both numeric and nonnumeric). Note that some required information may be reported within footnotes for schedules.

Additionally, no extensions are allowed. Besides concepts, axes and members are also to be used as provided. So, how do you report company-specific information, such as officer names? In order to support reporting of company-specific information, FERC uses the typed dimension.

The bonus for Workiva users? Although FERC uses a different technical specification, you will see the Workiva FERC reporting solution offers the same look and feel as axis/member application in the Workiva solution for SEC reporting.

NO OUTLINE MANAGEMENT OR CUSTOM DATES

For FERC reporting, no custom labels or label roles are needed. Labels are auto-assigned by the official FERC renderer based on form locations. Also, there are no calculation to define. In fact, custom calculations are not permitted. Validation rules will handle consistency checks.

Since FERC taxonomy assigns specific hypercube to each schedule,

there is no outline structure to build. For users of Workiva for FERC reporting, this is automatically managed by the Workiva platform.

Plus, fact ordering is not controlled by the outline and is not required. FERC uses a numeric element "OrderNumber" to control sequencing of company-specific information. Users of the Workiva solution for FERC reporting can easily assign row numbers in the form schedules as "OrderNumber" in the Workiva platform. Lastly, there are no custom dates as you're limited to a small list of allowable values.

SUBMISSION OF DATA AS INSTANCE DOCUMENT ONLY

Going forward, there is no digital form to submit. Machine-readable data is the key focus. Although not in iXBRL format, FERC's official form renderer will provide standardized viewing for the submitted XBRL data.

SUPPORTS REQUEST FOR CONFIDENTIAL DATA

Since most filing data to the SEC is public record, the SEC doesn't offer this, but FERC does. Whether FERC will actually approve a request for confidential data is another question! If you have an XBRL vendor for SEC reporting, make sure your vendor

also supports FERC compliance, since the FERC taxonomy will not be the same as the SEC reporting taxonomy.

PREPARE FOR YOUR NEEDS

Whether you outsource XBRL tagging, choose an XBRL software vendor, or invest the time and money to build and maintain an in-house solution for FERC compliance, understanding the similarities and differences between XBRL filings for FERC and for the SEC will be crucial when evaluating your options. ■

PERCY HUNG is director of structured data initiatives and **PETER LARISON** is manager of structured data initiatives at Workiva. Workiva, Inc. is a global software-as-a-service company. It provides a cloud-based connected and reporting compliance platform that enables the use of connected data and automation of reporting across finance, accounting, risk, and compliance. For more information, visit www.workiva.com.



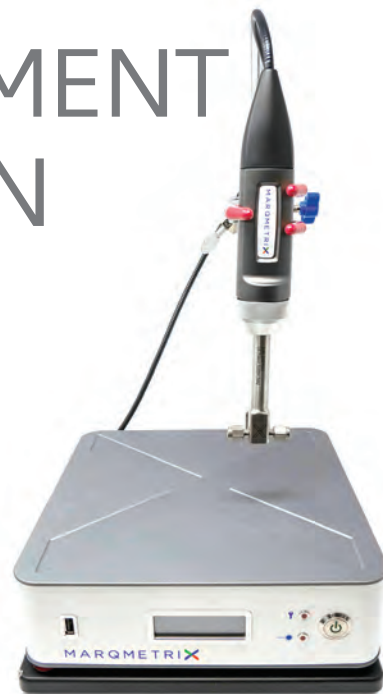
ADVANCEMENTS IN REAL-TIME MEASUREMENT OF LNG COMPOSITION

Raman spectroscopy system offers efficiency and accuracy during LNG processing and custody transfer BY MARC MALONE, MARQMATRIX

Representing nearly a quarter of the global energy mix, natural gas plays an important role in meeting worldwide energy needs. Throughout the natural gas supply chain, gas producers require accurate real-time measurement of the composition of liquid natural gas

(LNG) for in-process sampling or during transport for custody transfer.

LNG is comprised of methane with heavier components such as ethane, propane, butane, and trace elements such as sulfur compounds and aromatics. As such, data on the composition and concentration



The AIO system works with a wide array of contact probes suitable for LNG applications.

The system can effectively withstand direct contact with the sample even in extreme cold and hot environments, high pressure, and harsh corrosive conditions.

of the elements in the mixture can enable producers to increase process understanding and efficiency, improve quality, and establish the value of the product.

THE IMPORTANCE OF REAL-TIME MEASUREMENT

The need for real-time measurement begins when natural gas is converted into liquid form using one or more compressor trains for liquefaction and purification. Rundown lines then transfer LNG streams to storage tanks. By measuring the composition in the rundown, LNG producers better understand the product that is going into their tanks. This data enables them to predict how the LNG will age and better plan shipments by pipeline, train, and rail.

Although there are established techniques used for this type of measurement, these systems typically require samples to be extracted for testing, with results delayed for twenty minutes or longer. As a result, Raman spectroscopy is quickly gaining traction as an efficient, reliable, and economical alternative that can produce accurate, real-time results.

RAMAN SPECTROSCOPY: THEN AND NOW

Since its discovery in the 1920s, Raman spectroscopy has



revolutionized process analysis with its nondestructive mode of operation and capability to measure sample composition. Raman spectroscopy is a laser-based optical analysis technique used to measure compositions through the vibrational properties of molecules.

For many years, however, Raman equipment had the reputation for being expensive, cumbersome, and difficult to use. Now, advancements in the stability and portability of solid-state Raman systems and technological improvements in lasers, optics, and detectors have made the

technique faster and more accessible for real-time inline analysis.

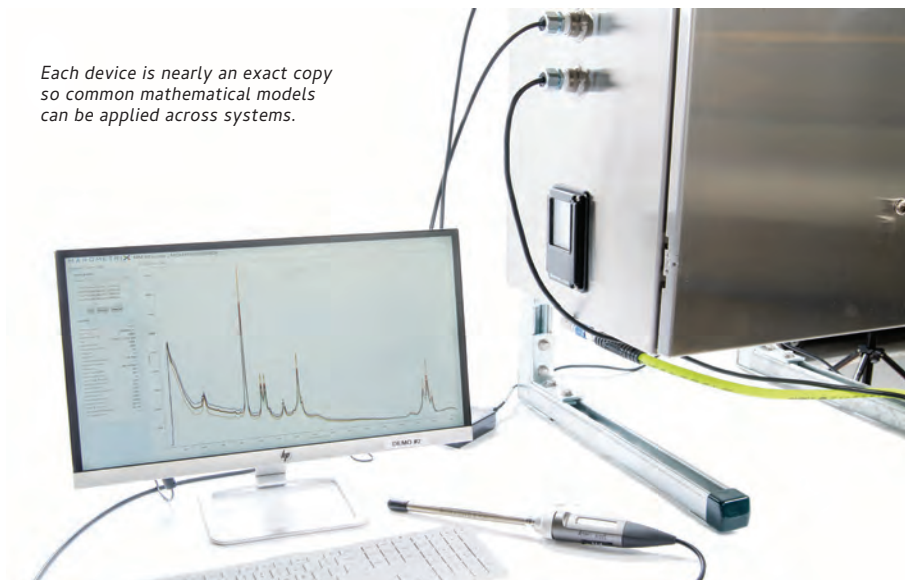
As a result, Raman is now increasingly being used as a powerful measurement solution for LNG composition and concentration. When applied to inline processes, Raman spectroscopy can provide results in seconds.

"Raman in the analysis of LNG composition is an important development," says Martin Mendez, lead research and development engineer at Analytical Solutions and Products B.V. (ASaP), an Amsterdam-based system integrator of LNG analysis and sampling measurement systems used around the world. "The use of Raman spectroscopy for LNG analysis is relatively new, and it has already proven to be a highly accurate, efficient, and usable compositional measurement tool."

RAMAN SPECTROSCOPY IN PRACTICE

Samples are collected using a 785nm excitation laser and a contact BallProbe that produces a unique spectral fingerprint that identifies the chemical composition and molecular structure in the LNG. The distribution of the spectral peaks describes the molecule's composition, while the signal intensity correlates linearly with concentration.

Each device is nearly an exact copy so common mathematical models can be applied across systems.





MarqMetrix has engineered its all-in-one (AIO) system to produce identical and repeatable results from unit to unit.

For easy-to-use commercial Raman spectroscopy instrumentation, ASaP works with Seattle-based MarqMetrix. Founded in 2012 by scientists from the University of Washington, the company specializes in compositional analysis utilizing Raman spectroscopy and has pioneered advancements in Raman for use in the energy sector.

MarqMetrix has engineered its all-in-one (AIO) system to produce identical and repeatable results from unit to unit, in a package 80 percent smaller than previous Raman instruments. Each device is nearly an exact copy so common mathematical models can be applied across systems to produce consistent results. Previous Raman systems were less reliable because each system required its own mathematical model and frequent recalibration for each installation.

The AIO system works with a wide array of contact probes suitable for LNG applications. The company's BallProbe is available in Hastelloy C-276—a nickel molybdenum-chromium superalloy to withstand extreme physical and chemical environments. The probe's spherical sapphire lens can effectively withstand direct contact with the sample even in extreme cold and hot environments -256 to 662 degrees Fahrenheit (-160 to 350 degrees Celsius), high pressure (> 400 bar), and harsh corrosive conditions.

"We work with MarqMetrix because they have a high-quality Raman instrument," says Mendez. "The company's immersion optic probes, which are widely used throughout the industry, enable users to achieve reproducible

measurements of samples better than 1 percent accuracy."

DIRECT MEASUREMENT IN REAL TIME

Another significant advantage of Raman spectroscopy is not having to take gas samples offline for measurement. Traditional techniques like GC require an injection system to add a sample gas to a chromatography column that allows the components to separate, and a detector to sense when a component is existing the system. But first, the LNG must be converted from liquid to gaseous state without partial vaporization before a reliable measurement can be made.

With a Raman system, no consumables are required for testing. "The contact probe is placed

MarqMetrix's BallProbe is available in Hastelloy C-276—a nickel molybdenum-chromium superalloy to withstand extreme physical and chemical environments.



directly into the LNG without having to manipulate the gas, take it offline, or introduce a carrier gas," explains Mendez. "With fewer steps involved in measurement, the uncertainty is reduced hence the measuring is much closer to the truth."

Raman's direct measurement of LNG produces readings every few seconds as compared to every three to five minutes or longer for traditional techniques.

"You want the real-time information, whenever possible," adds Mendez. "When it comes to a custody transfer, for example, it is ideal to take many representative samples throughout the entire offloading process to a tanker or ship as possible."

CALIBRATION AND PREDICTIVE MODELING

Although the MarqMetrix Raman equipment can be used to identify the components in LNG within approximately fifteen minutes of unboxing, quantifying the concentrations of each component first requires creating a predictive model.

To do this, ASaP establishes the accuracy of the Raman equipment at one of its three analytical testing facilities by comparing it against measurements produced by traditional GC equipment, with LNG supplied from a nearby filling station.

"We utilize certified GC testing instruments to produce a reference value that we know will be as close to the actual value as possible," explains Mendez. "We then take a measurement using the Raman equipment and compare the two (correlate the two measurements to build the model). The next step is to calibrate the Raman with a liquified primary gas standard."

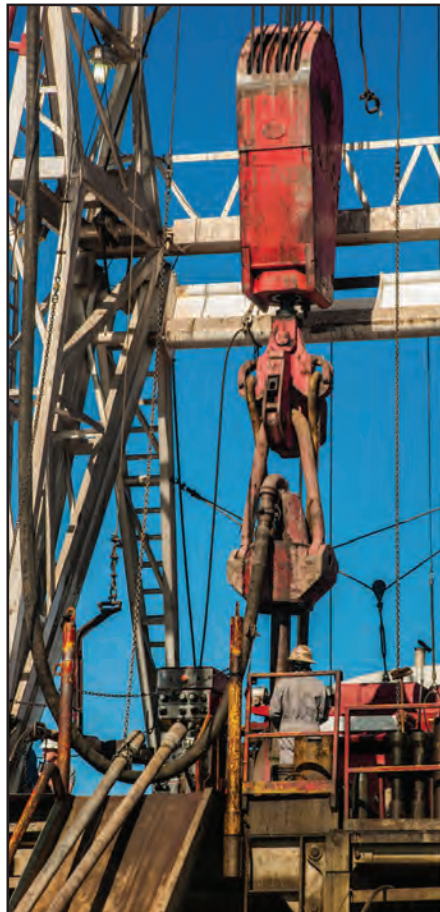
"We take a number of samples of LNG at different component concentrations and with the help of multivariate analysis we can create our predictive model," adds Mendez. "Once the model has been validated, ASaP clients no longer need to use GC and can use Raman exclusively

for instantaneous readings of the LNG composition.

Accurate measurement is nowhere more essential than ever in the LNG industry. Understanding the chemical composition of raw materials and the consistency of processed products. With the advancements made in applying Raman spectroscopy systems to sample measurement, LNG producers have a practical tool for generating accurate real-time compositional measurements for their in-process and in-transit LNG sampling needs.

"With the availability of easy-to-use commercial instrumentation, the threshold to work with Raman spectroscopy has now become approachable and workable for LNG applications," says Mendez. ■

MARC MALONE is vice president, business operations and strategy for MarqMetrix. MarqMetrix works with a number of recognizable global and private sector brands across a multitude of industries that include pharmaceuticals, oil and gas, biotech, and food and beverage. For more information, call 206.971.3625 or visit www.marqmetrix.com.



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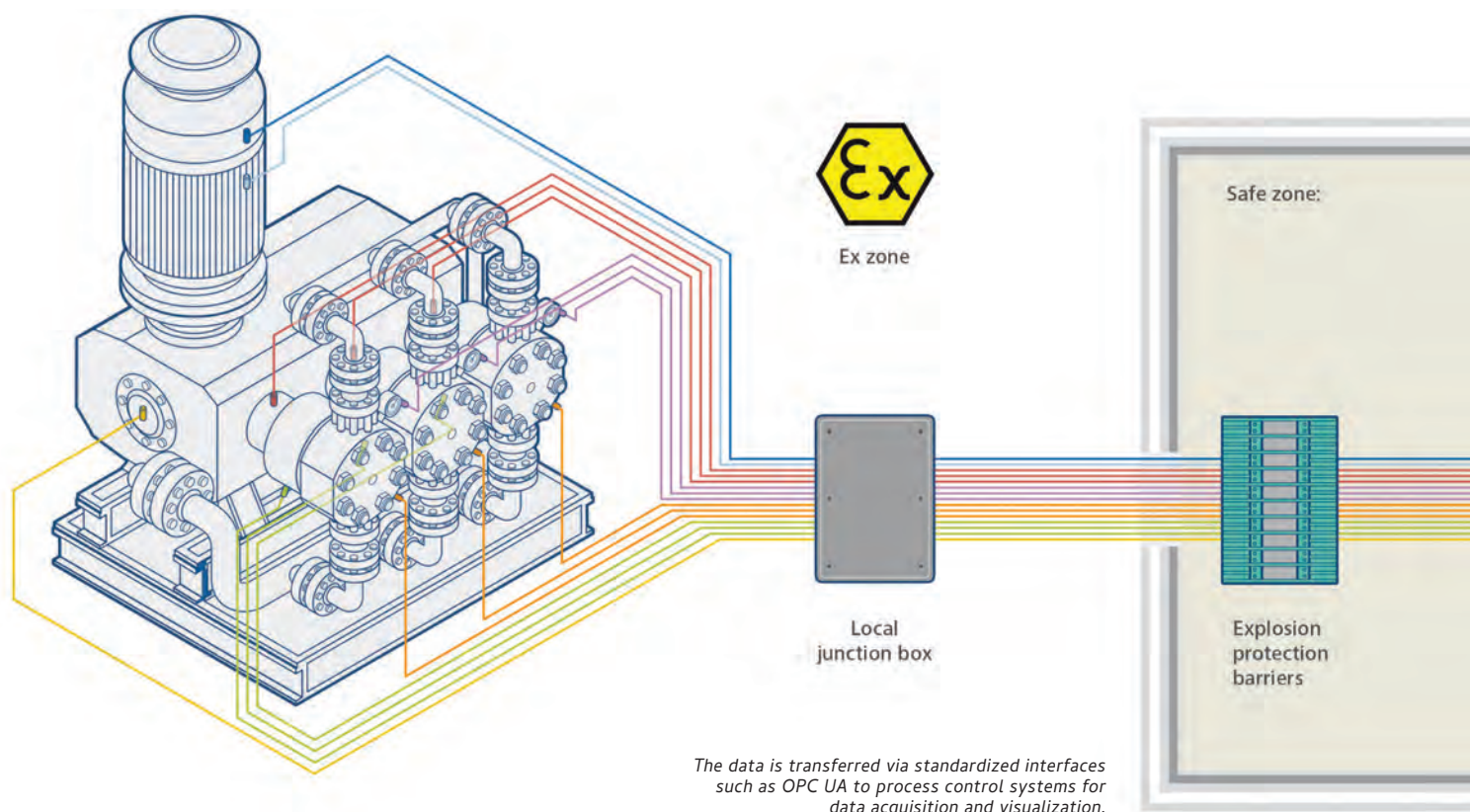
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SMART MONITORING TRACKS PUMP OPERATION AND PROVIDES OPERATING FIGURES

Intelligent pump systems bring about the next evolution of the digital factory

BY SEBASTIAN GATZHAMMER, LEWA GMBH



The new monitoring system from Lewa lets operators sleep more soundly and makes pumps smart-factory-ready: In addition to detecting malfunctions and process deviations, smart monitoring also provides important key figures for the economic evaluation of the plant. Lewa provides additional support with operational analyses of the runtime data. Data sovereignty always lies with the operator.

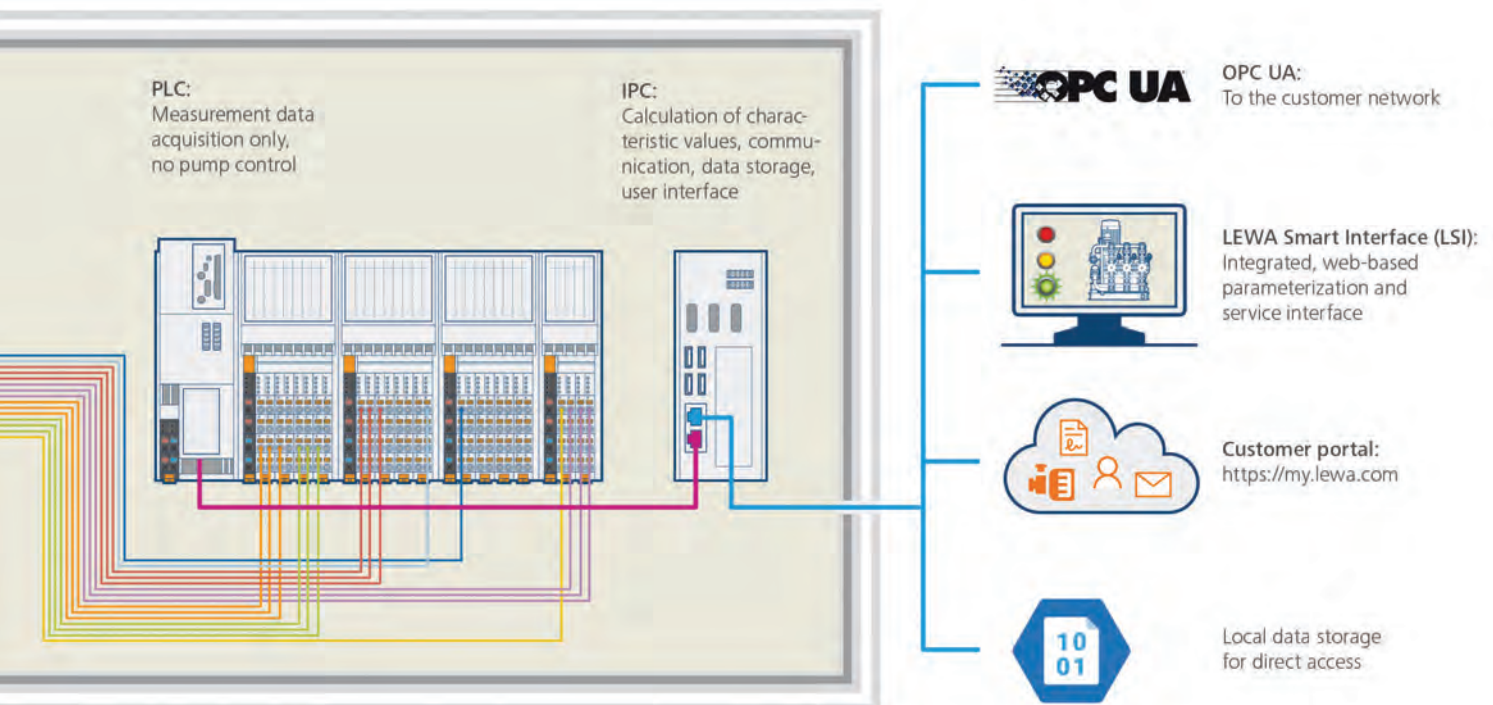
The continuous operation of pump systems in critical applications goes hand-in-hand with high expenditures for monitoring and maintenance. Recording plant operating parameters such as flow rate, temperature or pressure also often requires additional expensive and high-maintenance instrumentation. For this reason, Lewa GmbH, as a specialist for pump systems, has developed smart monitoring for its ecoflow and triplex models: A combination of sensors integrated into the pump and software-based

evaluation provides the user with comprehensive information on the performance and condition of the pumps. Malfunctions and wear development are detected before they lead to unscheduled shutdown. This way, the service life

of the pumps can be increased and maintenance can be planned more easily. Lewa also offers data analysis as a service. Here, customers not only receive a data-based assessment of the condition and operating efficiency of the pump, but



Thanks to the structure-borne sound characteristics, wear and tear on valves can even be detected before it becomes measurable in the flow rate of the system.





The measured values come from a structure-borne sound transmitter located on the pump body, a pressure transmitter connected to a pressure measuring bore, and a rotary encoder adapted either directly via the crank shaft or the engine. Here you can see the pressure transmitter.



Smart monitoring provides information on the performance and condition of the ecoflow and triplex metering and process diaphragm pumps based on up to 13,000 values processed per second.

also optimization recommendations for the entire system.

MORE COMPLEX PRODUCTION PROCESSES REQUIRE MORE PUMP KNOWHOW

For reliable use of pumps and pump systems in everyday industrial applications, regular inspection of the units is absolutely essential. Wear and malfunctions must be detected before costly unplanned shutdowns occur. Time-consuming inspection rounds are thus the basis for repairs and maintenance work, but do not always capture all functional deviations. Because the requirements are increasing due to ever more complex production processes, the specific pump know-how of the operator is continuously decreasing. For these reasons, companies are turning to digital assistance systems to control and monitor the entire production line. But only if the plant components can also be integrated into these systems by means of interface integration and characteristic value transmission, the step towards the smart factory—the digitized production facility—can be taken.

SMART MONITORING FOR NETWORKED PUMP MONITORING

To meet these challenges, Lewa GmbH, as a pump specialist with experience in critical applications, has developed a product for complete and networked pump monitoring: Smart monitoring provides information about the performance and condition of the ecoflow and triplex metering and process diaphragm pumps based on up to 13,000 sensor signals processed per second. In the process, data on structure-borne noise, hydraulic pressure, temperature and angle of rotation is collected by multiple sensors and processed by our software to come up with meaningful key figures.

This system largely serves as a replacement for inspection rounds, since digital monitoring immediately



The smart monitoring system is already cloud-ready and can be networked with other systems via the Microsoft Azure cloud.

detects wear and malfunctions on both the fluid and hydraulic sides and reports them to a process control system at the operator via the interface. This means that around 90 percent of malfunctions can be detected at an early stage: for example, overpressure in the hydraulics, worn plunger rings or incorrect closing behavior of valves. Faults in the entire system beyond the Lewa unit are also measured indirectly. We can use the pump data to interpret changes in the condition of the pumped fluid, possibly due to contamination.

THIRTY DIFFERENT DIAGNOSES MONITOR FLOW MEASUREMENT WITHOUT ADDITIONAL INSTRUMENTATION

However, detailed monitoring also results in other advantages such as better planning of maintenance intervals. The plant control center learns of any functional deviation in real time so that maintenance can be planned in advance and carried out in a controlled manner. In potentially explosive working areas, this also means a significant increase in safety. Possible accidents are prevented and overall plant availability increases significantly. By monitoring up to thirty different diagnoses, the technical management always has an overview. This was possible because the smart monitoring system is the product

of more than sixty years of Lewa's pump expertise. With the interaction of sensors and hardware, we can detect as little as a one percent drop in flow rate in each pump head. But thanks to the structure-borne sound characteristics, we even detect signs of wear on valves at a very early stage, before they even become measurable in the flow rate of the system.

ADDED VALUE THROUGH DATA ANALYSES / DATA SOVEREIGNTY WITH THE OPERATOR

Lewa offers data analysis for the smart monitoring systems. We analyze and evaluate the operational data that a system has collected over a period of time. This allows us to do more than just provide the customer with data-based recommendations for maintenance planning based on wear patterns. The overall plant efficiency can also be optimized in this way. The data is transferred via standardized interfaces such as OPC UA to process control systems for data acquisition and visualization. In addition, the smart monitoring system is already cloud-ready and can be networked with other systems via the Microsoft Azure cloud. However, this decision—and thus also the data sovereignty—always lies with the operator.

After successful completion of the pilot phase, the Lewa smart monitoring was launched mid of October 2021. Lewa smart monitoring

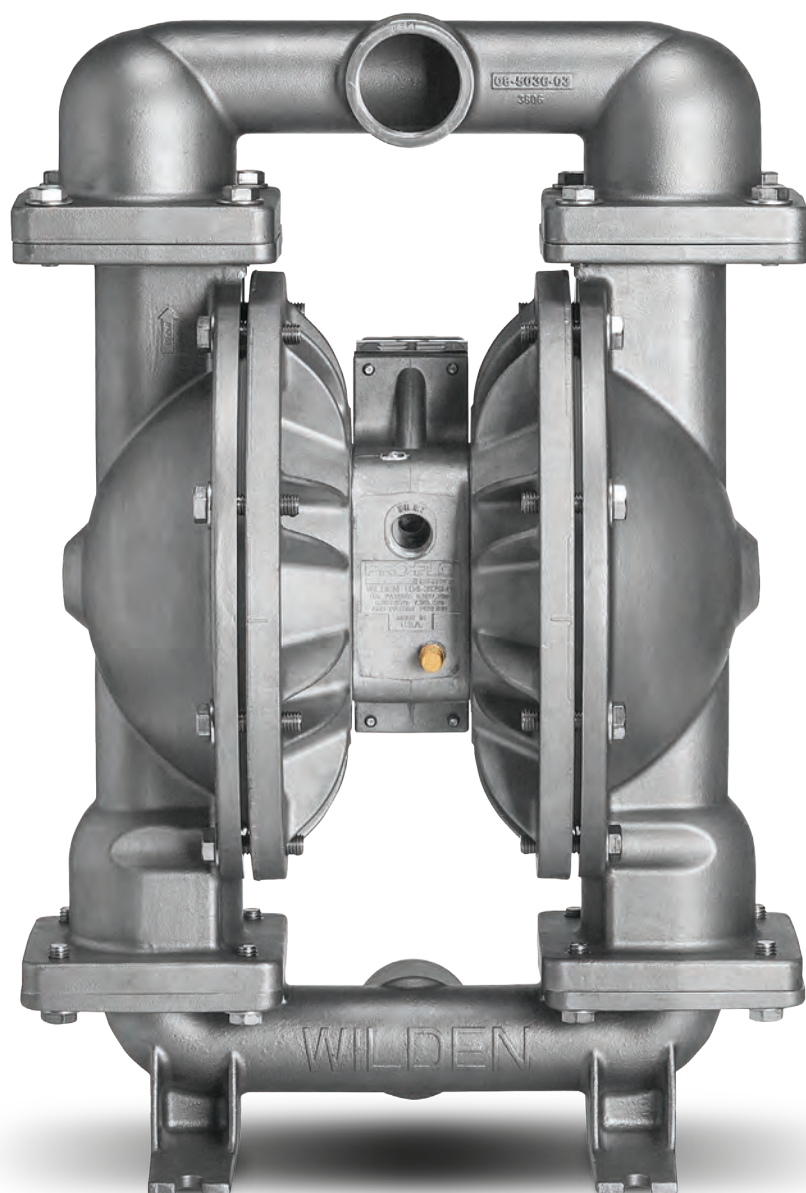
according to North American certifications will be available soon. ■

SEBASTIAN GATZHAMMER is development engineer at Lewa GmbH. Lewa is the world's leading manufacturer of metering pumps and process diaphragm pumps as well as complete metering packages for process engineering. The Leonberg, Germany-based company developed into an international group within a few decades and saw further improvement in its position on the world market as part of integration into Japanese Nikkiso Co. Ltd. in 2009. As a research and production-oriented company, Lewa develops technologies and provides solutions for the vast array of applications among its customers. Its products are used mainly in the oil and gas industry, in gas odorization and in refineries and petrochemicals, as well as in the production of plastics, detergents and cleaners. Additional application areas include the chemical industry, the cosmetics industry, pharmaceuticals and biotechnology, food and beverage industry and energy utilities. For more information, visit www.lewa.com/en/services/digital-services.

HOW AODD PUMPS CAN SATISFY ALL DEMANDS IN MINING OPERATIONS

In an industry with both harsh yet delicate liquid-handling challenges, Wilden AODD pumps rise to the occasion

BY FERNANDO MENESES, WILDEN



Mining is one of the world's oldest industries, tracing its roots back to those prehistoric days when someone grabbed a digging instrument and began burrowing into the ground. In the many millennia since, mining has grown into one of the world's most important and widespread commercial enterprises, with operations spread across the globe while tasked with recovering an almost inexhaustible list of valuable commodities.

In fact, according to the World Mining Congress's *World Mining Data 2020* report, 17.7 billion metric tons of mined products were recovered in 2018, up from 11.3 billion metric tons in 2000 and nearly double the 9.6 billion metric tons in 1985. Asian countries accounted for 58 percent of the 2018 production, with North America second at 15.1 percent, followed by Europe (8 percent), Oceania (6.8 percent), Latin America (6.3 percent), and Africa (5.3 percent). Individually, China (23 percent), the United States (12.1 percent), Russia (9.2 percent), and Australia (7.2 percent) were the most prolific producers, with their total 51.1 percent of production more than the rest of the world combined.

This means that the mining industry is a strong one, with solid growth expected to continue in the coming

years in many regions of the world. It also means that mining operations will continue to rely on pumping technologies that offer robust, reliable, and safe service in a number of critical liquid-handling operations. This white paper will illustrate why positive displacement air-operated double-diaphragm (AODD) pumps can be the best choice for many of those applications.

THE CHALLENGE

While mining might appear to be nothing more than a rough-and-tumble operation—holes are dug by heavy machinery or with explosives, opening the hidden ore to access from above—there are, in fact, many complex and sometimes delicate operations that must be performed properly if the mining operation is to perform at its highest level of efficiency.

From a macro standpoint, this requires a pumping technology that can operate reliably in harsh and remote locations, even when submerged, or when tasked with handling particulate-laden liquids or toxic/corrosive products, and also one that is able to be maintained and repaired simply so downtime is lessened. The pumps must also be light enough to be manually moved from location to location within the mine itself.

For many years, a popular choice for use in these conditions was centrifugal pumps. While centrifugal pumps are able to create the high flow rates that are required, they have a number of operational “pain points” that hamper their use in mining applications: an inability to self-prime or run dry; special seals needed to prevent leaks; special linings needed to handle solids; high motor speeds of up to 1,800 rpm; and relatively high maintenance requirements and costs, especially when charged with transferring solid-heavy liquids.

Another popular choice has been the progressive cavity pump, but, like centrifugal pumps, they have a number of operational shortcomings. These include an inability to consistently handle liquids with high



levels of abrasives, which leads to increased maintenance costs, wear on expensive stators and rotors that will eventually need to be replaced, and overall higher purchase, operating, and repair/replacement costs.

Here are some of the specific liquid-transfer operations that take place in a mine and the ways that some pump technologies can fall short in satisfying them:

- **MINE DEWATERING:** Removing excess produced water from the mine is a critical 24/7/365 operation and the water that is recovered is often full of particulates that can be as large as 0.12 to 0.16 inches in size. If used in this application, centrifugal pumps require special materials of construction, which can be cost prohibitive, to protect against impeller wear caused by

the abrasive particles. Centrifugal pumps are also not dry-run capable, which adversely affects their level of performance in this application.

- **GENERAL SERVICE:** For common liquid-handling applications, you need an easy-to-operate pump that reliably can run dry, strip lines, operate at low speeds while still delivering high flow rates, and be easy to maintain and repair. Centrifugal pumps simply do not possess these capabilities.
- **CORROSIVE LIQUIDS:** Much like solid-laden liquids, corrosive ones can wreak havoc on the wetted parts of centrifugal and progressive cavity pumps. This typically demands a need to use special mechanical seals, which can lead to exorbitant maintenance, repair, and replacement costs.

- **PRESS FILTER:** Press filters are used to clean the liquids that are produced in the mines and, again, centrifugal pumps can fall short in this application because the solid-laden liquid can damage the pump's internals unless special, more expensive materials of construction or linings are used. Also, the nature of press-filter operation creates a strong discharge-pressure variation that can force the centrifugal pump to operate away from its best efficiency point (BEP), resulting in high vibration and radial loads that can lead to shortened service life. A solution to this is the incorporation of variable frequency drives (VFDs) and controllers, but these are expensive and can negatively affect the cost-effectiveness of the operation.
- **PRODUCT TRANSFER:** This comes in all forms in a mining operation, from loading and unloading from transport trucks with new and used oil for the heavy machinery, fresh and fouled water, and any chemicals that are required. In every instance, there is the risk

that the pump will be forced to run dry as the truck or storage vessel is emptied, while discharge-pressure variation can also generate high vibration and radial loads. As previously illustrated, centrifugal pumps cannot run dry, so they need protection from this condition or the addition of special seals. However, all of these upgrades still cannot totally protect against a catastrophic failure.

THE SOLUTION

While centrifugal pumps—despite their popularity—have proven to not be the most effective solution in many liquid-handling applications in mining, one pump technology that has proven to be an optimum choice is AODD—in terms of maximizing reliability, cost-effectiveness, ease of operation and maintenance, and safety for mining personnel and the environment.

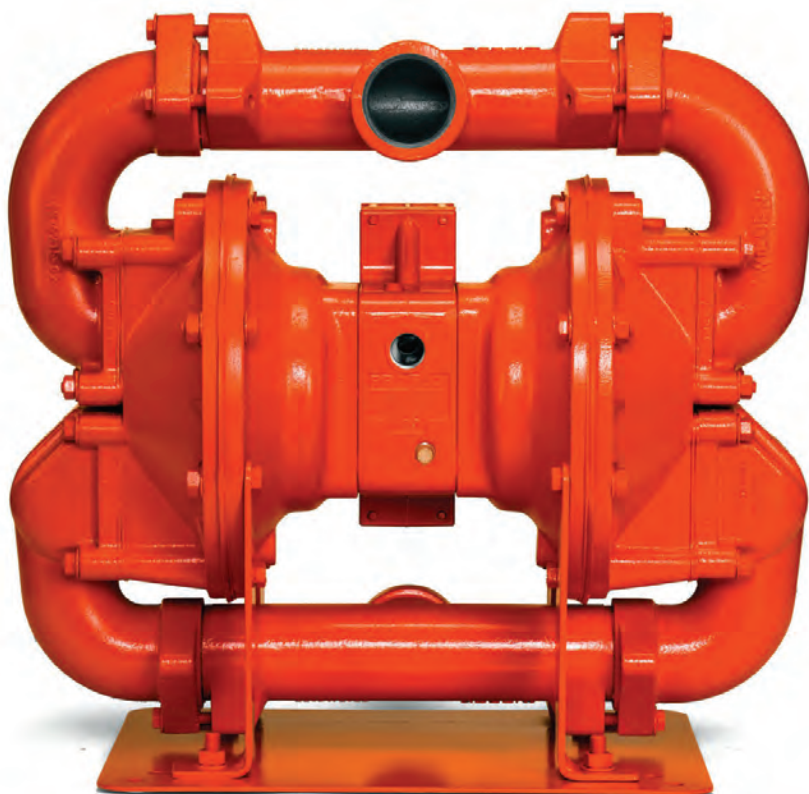
AODD pumps are able to perform effectively in mining applications because their method of operation allows them to easily handle variable flow rates and pressures, while being

dry-run and line-stripping capable, and nimble enough to transfer liquids that are shear-sensitive or high-viscosity, as well as slurries laden with rocks, pebbles, and other particulates.

The simple design of the AODD pump features few moving parts and comparably lower speeds than other pump technologies, which improves reliability and simplifies maintenance, while the pump's seal-less construction results in fewer leaks, which is a critical consideration when handling the many hard-to-seal, corrosive, or hazardous liquids that are prevalent in a mining operation. AODD pumps are available in both metal (most commonly aluminum, ductile iron and cast iron) and plastic (polypropylene and PVDF) housing constructions, while a wide array of elastomers can be used in the diaphragms, which eliminates many chemical-compatibility concerns.

A wide variety of AODD pump configurations provide operational flexibility that can also result in optimized performance at many levels. The ability to feature AODD pumps in a wide range of applications, from basic general use to delicate chemical-handling processes, allows operators to more cost-effectively outfit their mines. AODD pumps can also be less costly to operate, especially those models that are outfitted with a next-generation mechanically actuated air distribution system (ADS). At their most basic, AODD pumps excel in the typical rugged and harsh operating conditions found in the world's mines, which reduces breakdown incidents along with corresponding downtime and repair costs.

Specifically, Wilden, whose founder, Jim Wilden, conceived the AODD pumping principle sixty-five years ago, has been dedicated to developing technologies that meet the needs of mining operations. Today, Wilden offers three AODD pump models that are built to excel in mining applications, available in ductile iron, cast iron, aluminum,



polypropylene and Kynar materials of construction:

- BRAHMA® SERIES:** The Brahma pumps, which feature a bolted configuration, have been built for use in applications that require the handling of liquids featuring large solids. The Brahma pumps have a unique top-inlet/bottom-discharge flow orientation and flap valves that allow the passage of large solids with no risk that damage will occur as a result of product entrapment or the settling of solids within the pump's internal flow paths. Brahma pumps are available in two models—PS810 (2-inch) and PS1510 (3-inch)—that are outfitted with the revolutionary Pro-Flo® SHIFT ADS, which has been designed to reduce air consumption by up to 60 percent. The T810 and T1510 models are powered by the Turbo-Flo™ ADS, the industry's first air motor for AODD pumps. The flow-rate range for the four Brahma pumps is 166 to 258 gallons per minute at pressures up to 125 psi with solids-handling capability ranging from 2 to 3 inches.
- STALLION® SERIES:** The Stallion pumps feature a clamped design with carrying handles for lightweight portability. Their design features large internal clearances and flow-through paths for easy passage of large solids with no chance for clogging. An altered ball/seat check-valve assembly further enables solids passage, while a polyurethane screen base at the inlet increases the pump's durability. The PS4, PS8, and PS15 (1.5-, 2-, and 3-inch) models are powered by a Pro-Flo SHIFT ADS, with the T4, T8, and T15 (1.5-, 2-, and 3-inch) pumps featuring the Turbo-Flo ADS, Wilden's most robust ADS design for the toughest environments. Flow rates amongst the six models range from 57 gallons per minute to 232 gallons per minute at working pressures up to 125 psi.

Solids sizes that can be handled range from 1/2 to 1 inch.

- PRO-FLO SHIFT SERIES:** Pro-Flo SHIFT pumps feature clamped or bolted configuration. Their design features different chamber materials, including metal and plastics, even Kynar, which is

capable of handling high levels of abrasive materials. The Pro-Flo SHIFT is also the most efficient AODD pump in the market, capable of reducing up to 60 percent air consumption. This makes it the best option for handling corrosive and abrasive

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products in mining processes. The pumps have a product range that goes from 1.5 to 3 inches and flows from 2 to 271 gallons per minute.

All of the Brahma, Stallion, and Pro-Flo SHIFT pumps are able to be outfitted with a wide array of diaphragm styles—including the newer Chem-Fuse, EZ-Install, and Reduced-Stroke models—in a varying array of materials, such as Wil-Flex™ (Santoprene®), Geolast®, Polyurethane, Buna-N®, EPDM, Neoprene, FKM, and PTFE. This diaphragm range gives users the widest selection of diaphragms on the market, all of which are capable of providing extended mean time between failure (MTBF) for optimized uptime with reduced maintenance, repair, and replacement costs.

All of these capabilities make AODD pumps the ideal choice for the aforementioned common liquid-handling applications in mining: dewatering, general service, corrosive-handling, filter press, and daily product transfer.

CONCLUSION

In summary, Wilden AODD pumps are the best option for mining applications because they offer considerable operational advantages, like comparable low-speed operation, dry-run, line-stripping, self-priming, and deadhead capability, along with increased operational safety and a reduction in maintenance/repair costs that can be incurred by pumps that are not designed to handle abrasive/corrosive or solid-laden liquids.

Wilden AODD pumps also outperform other AODD technologies in other significant ways: simple design with the lowest number of parts for faster, simpler, and safer repairs and the lowest number of spare parts to stock; recent improvements in materials of construction that increase the pump's MTBF; and improved efficiency through the use of the Pro-Flo SHIFT ADS, which ultimately results in faster product transfer with lower air consumption. Wilden also continues to innovate through the development of

the next-generation Chem-Fuse and EZ-Install diaphragms, both of which increase service life and safety while not compromising the handling of challenging liquids. ■

FERNANDO MENESES is the regional manager North Latin America for Wilden, a leading manufacturer of air-operated double-diaphragm (AODD) pumps. He can be reached at fernando.meneses@psgdover.com. Wilden is a product brand of PSG®, a Dover company. PSG is comprised of several leading pump companies, including Abaque®, All-Flo™, Almatec®, Blackmer®, Ebsray, em-tec®, Griswold®, Hydro™, Mouveux®, Neptune®, Quantex™, Quattroflow®, RedScrew™, and Wilden®. For more information, visit www.wildenpump.com or www.psgdover.com

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HEAVY-DUTY COMMERCIAL DRAIN PUMP MAKES RENOVATIONS POSSIBLE

Saniflo's Sanicom 2 drain pump solves plumbing challenges at Rhode Island brewery

BY ARNAUD CORBIER, SANIFLO

Revival Brewery Company provides a distinctive craft beer experience that appeals to everyone. It is a renewal of brewmaster Sean Larkin's passion for unique and innovative craft beers, cultivated over twenty years of creating signature brews for the preeminent breweries in Rhode Island.

Though he'd been thinking about striking out on his own for a few years, it was an introduction to avid home brewer Owen Johnson in late 2009 that set in motion what would become Revival. After many nights of brainstorming, Revival Brewery Company decided to reinvent itself in a post-pandemic world with the timeless combination of beer and pizza. The owners created Revival Brewing and Lost Valley Pizza, a brewpub and pizzeria located in the Valley neighborhood of Providence, Rhode Island.

After reopening the brewpub in a new building, the owners had various projects lined up to improve the space, including additional bathrooms and a new bar area.

However, the brewery's new location posed a difficult plumbing situation. According to Geoff O'Leary, owner of O'Leary Plumbing and Heating, they had originally planned to install traditional underground drain lines, but "during the initial construction of the brewery, they

utilized a space without any plumbing plans available, so we had no idea what the plumbing setup looked like," explains O'Leary.

"We knew there were drain lines in the floor, but we didn't know where we wanted to install the restrooms or the bar area," he continues. "We later realized the concrete was three feet thick, making any new plumbing installation particularly difficult and expensive."

PROBLEM

Thankfully, O'Leary knew of a product he had been using over the entire span of his twenty-year plumbing career: Saniflo's above-floor plumbing pumps, a solution that would allow them to install plumbing without needing to break through that 3-inch-thick concrete to install new drain lines.

"I've been using Saniflo's residential line of macerator pumps since it was first introduced in the United States," says O'Leary, who serves the Eastern, North, and South Shores in Massachusetts providing residential and commercial plumbing services.

After presenting the challenges they were facing at the brewery to manufacturers representative Walter F. Morris, they introduced him to Saniflo's commercial line of drain pumps and lift stations. A Morris representative recommended

Saniflo's Sanicom 2 to handle the drainage for a new bar area. Walter F. Morris also recommended Saniflo's Sanicubic 2 to handle two unisex restrooms. Down the line, the brewery faced additional issues when they had to add a sink close to the pizza oven per the Health Board's request and, again, when they finally started the construction of the new bar area.

SOLUTION

After learning more about Saniflo's Sanicom 2 commercial drain pump and the Sanicubic 2 lift station, O'Leary knew it would solve the brewery's original concrete trenching issues.

"The Sanicubic set the standard for the brewery and helped out tremendously, because we could go from one staff bathroom to providing two bathrooms for the public," O'Leary explains.

After successfully opening and providing the necessary amenities to customers, the brewery had to add a hand sink near the pizza oven. O'Leary explains there were no drain pipes available close enough to the oven, so they had to find another Saniflo solution. O'Leary decided to install the Saniswift drain pump, which enabled them to tie into the existing drain line, located above the doorway almost 30 feet away from the new hand sink.



Soon after, Revival Brewing and Lost Valley Pizza was ready to start the construction of the new bar area. The bar would include two washing machines, a three-base sink, and ice bins. The new Sanicom 2 served as the plumbing solution for the bar area. The Sanicom 2 is a heavy-duty duplex drain pump designed for applications requiring gray water removal for commercial needs.

Recently introduced into the market, the Sanicom 2 comes equipped with a pair of 2-horsepower, 220-volt motors for handling multiple commercial fixtures that must process large volumes of high-temperature water, grease or chemicals. The duplex drain pump can move up to 140 gallons of fluid per minute, with both pumps automatically activating simultaneously when the incoming flow rate exceeds that of a single pump.

Other key features of the Sanicom 2 include:

- **EASY ACCESS FOR SERVICING:** The Sanicom 2 has been designed to keep maintenance to a minimum. If servicing is needed, the two motors, electrical components, pressure-level switches, and dip tubes are all readily accessible and easily removed.
- **FAIL-SAFE ACTIVATION:** A fail-proof sensing mechanism system for detecting the water level inside the Sanicom 2 consists of three pressure switches, each installed in its own internal dip tube. With three different switches, it is nearly impossible for the unit to fail to activate with incoming fluids.
- **CONTROL PANEL:** The unit comes equipped with an external wired control panel with override buttons and



LED power and alarm indicators. An external alarm box is optional.

- **NATIONWIDE COMPLIANCE:** IAPMO-listed and carrying the UPC (Uniform Plumbing Code) logo, the Sanicom 2's duplex technology is an excellent fit for many U.S. locales and jurisdictions.

Like the Sanicom 1 drain pump, the new duplex model can handle fluids up to 194 degrees Fahrenheit (90 degrees Celsius), making it ideal for industrial-scale dishwashers, commercial washing machines, hydroponic crop growing, and any other commercial and industrial applications requiring wastewater evacuation. With horsepower ratings higher than other Saniflo systems, the Sanicom 2 discharges effluent through a 1.5-inch pipe vertically 32 feet and/or horizontally 390 feet. The pump comes equipped with built-in check valves on the discharge of each motor.

Accommodating the brewery's new bar, the Sanicom 2 pumps the wastewater from three fixtures 15-feet vertically and then 30-plus-feet horizontally via a 1.5-inch discharge pipe. At a quarter-inch slope per foot, the discharge then runs into the main drain on the other side of the wall.

RESULTS

"Depending upon the length of your run into a drain line, it could take as little as an hour to install the Sanicom 2," says O'Leary approvingly. "But it was a twelve-hour job for us at the brewery, because we had a lot of piping to run and had to install venting."



According to O'Leary, the installation was very easy and went smoothly for him and his team. "We effortlessly connected the drain lines to the pump and installed a shut-off for the ejection side for maintenance down the line," he says, adding, "I was amazed how high and far the Sanicom 2 is able to pump the drain water to the sewer line, yet the unit itself tucks right under the bar."

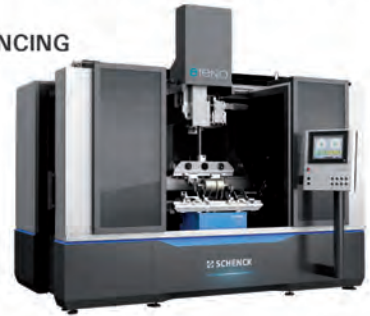
Besides not obstructing the bartenders or the staff, the Sanicom 2 offers easily accessible electrical hookups, according to O'Leary: "The electrician raved about how simple and easy it was to make connections."

O'Leary reports that "the bar is now up and running, and the owner's feedback has been unbelievably positive"—thanks in no small part to Saniflo's heavy-duty commercial drain pumps and lifting station. 🟡

Saniflo is the world leader in the plumbing industry as a result of the above-floor technology used in Saniflo pumps. The Saniflo's complete range of pumps, for both residential and commercial needs. The innovative method of using above-floor technology allows the installation of any sanitary application, anywhere. Whether it's a small project requiring drain and condensate pumps to more complex engineered jobs, such as a whole buildings with multiple fixture units, Saniflo has a solution. For more information, visit www.saniflo.com.

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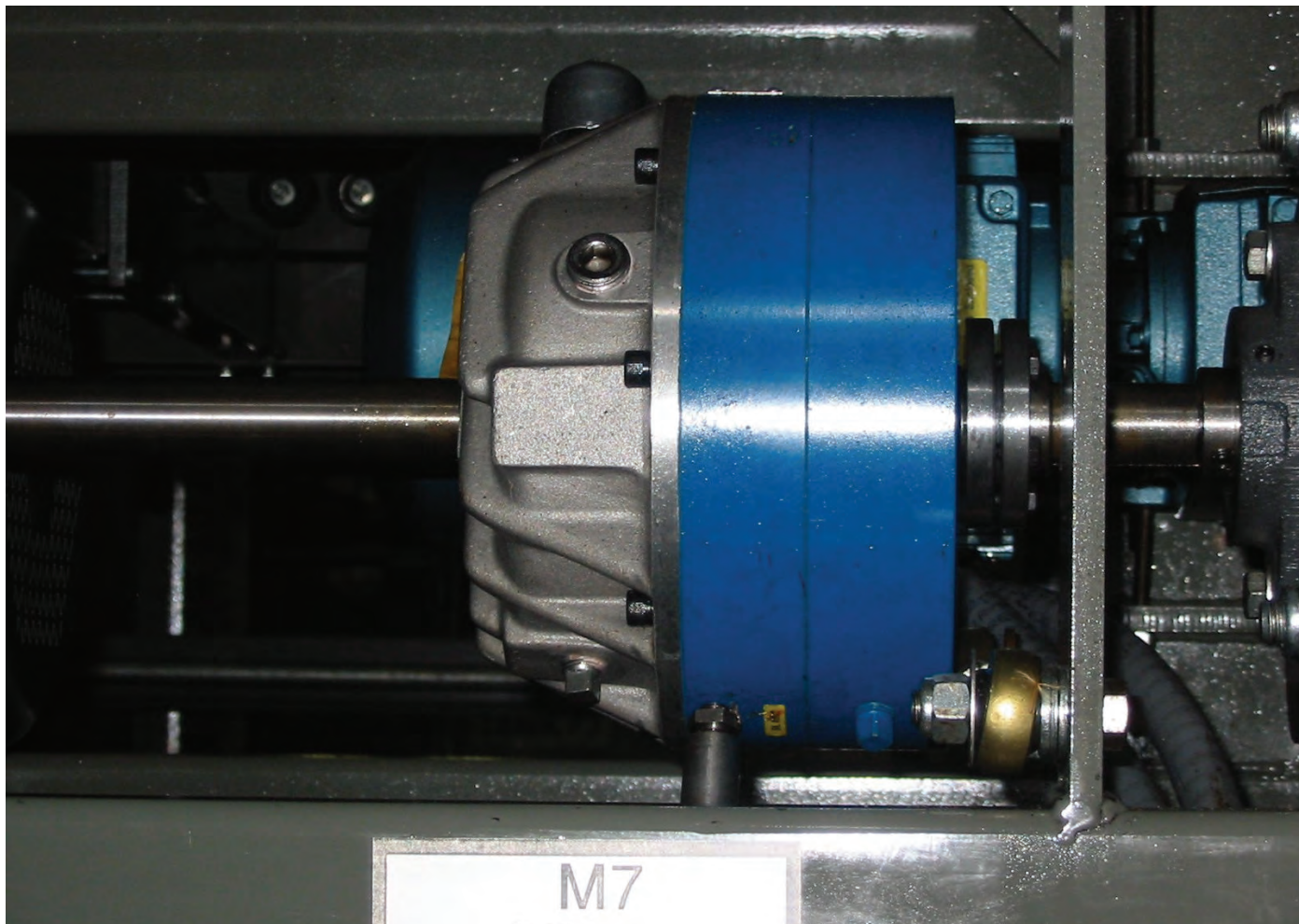
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LONGER SERVICE LIFE WITH NO MAINTENANCE A REALITY

Oil shear motor brakes provide a maintenance-free solution for palletizers

BY KEN KELLY, FORCE CONTROL INDUSTRIES

Force Control motor brakes employ oil shear technology, providing a longer service life with no maintenance or adjustment in demanding palletizer applications.

Proven oil shear technology transmits torque between lubricated surfaces—thereby eliminating wear on friction surfaces. A patented fluid recirculation system dissipates heat—

eliminating heat build-up, which is the most common failure mode in dry-friction braking systems. The elimination of the wear significantly increases service life and virtually

eliminates adjustment, which also elongates maintenance intervals.

In addition to palletizers, they are ideal for applications where the motor is stopped/started frequently, or reversed each cycle such as cranes, winches, and hoists, conveyors, rail car spotters and dumpers, ship and rail car loading conveyors, trippers, and pallet return conveyors. The oil shear technology also provides a smooth "cushioned" stop that reduces shock to the drive system, further extending service life of downstream components.

Force Control's totally enclosed, IP56-rated motor brakes are impervious to moisture, dirt, and dust that is common in concrete block plants as well as asphalt shingle manufacturing, coal, bulk materials handling, forest products manufacturing, and more.

HOW OIL SHEAR WORKS

Unlike dry-friction brakes, oil shear technology employs a layer of

automatic transmission fluid between the brake disc and the drive plate. As the fluid is compressed, the fluid molecules shear—thus imparting torque to the stationary surface, and bringing the rotating surface to a stop. Wear is virtually eliminated, as is the need for adjustments that are common for dry braking systems.

In addition to transmitting torque, a patented fluid recirculation system helps to dissipate heat, which is the major problem with traditional dry brakes. Along with heat removal and torque transmission, the fluid serves to continually lubricate all components of the oil shear brake, elongating their service life.

Force Control brakes with oil shear technology provide significantly longer service life, characterized by virtually maintenance-free operations.

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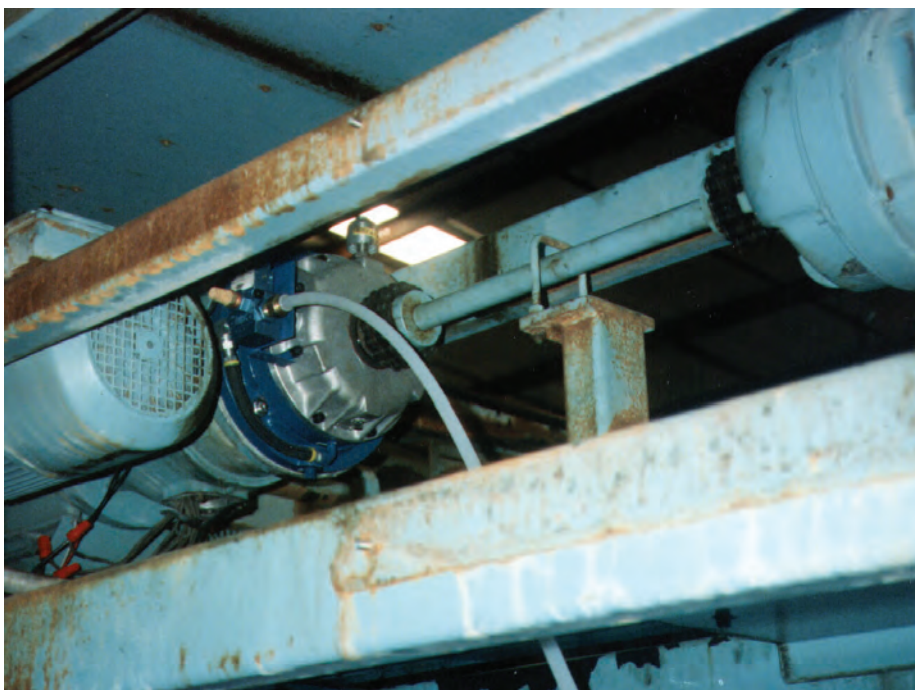
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Headquartered in Fairfield, Ohio, Force Control Industries is a world leader in oil shear technology, offering a full line of clutches, brakes, and clutch brakes for OEMs in diverse applications. Their manufacturing campus includes three manufacturing facilities with over 100,000 square feet of manufacturing space along with engineering, design, customer support, and administrative offices. For additional information, call 513.868.0900, email sales@forcecontrol.com, or visit www.forcecontrol.com.

proven motor brakes are available to accommodate a wide range of applications. Force Control motor brakes can be sized to the correct torque independent of the motor frame size or horsepower.

A “quick mount” feature is available for quick and easy mounting of MagnaShear® brakes to drive motors in NEMA frame sizes 56 to 449. They are shipped ready to install, with no assembly or adjustments required. They are also available pre-mounted on a motor for severe duty applications. Force Control motor brakes can be furnished to fit a NEMA or IEC frame motor, as a complete motor and brake assembly, or to mount on a machine frame or other special mounting configuration.

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Scott Farrington (operator II) at Montville WPCWWTF.

CONNECTICUT FACILITY EMBRACES SEPTAGE

Lakeside's screening technology accepts a rugged challenge

BY DAN WIDDEL, LAKESIDE EQUIPMENT CORPORATION

Two things are perhaps certain about septage: it is highly variable and by its very nature, spewing odorous compounds and elements that can cause disease, it is "objectionable." Or is it?

With endless amounts of grease, grit, hair, and debris and being a not surprisingly very unpleasant in

appearance and odor (hydrogen sulfide, mercaptans, and other organic sulfur compounds), viruses, bacteria, and parasites; it's not exactly charm personified. But according to the Environmental Protection Agency (EPA), septic tanks are used for more than 20 percent of homes in the United States. Some 6,500 businesses

employ over 30,000 people in an industry worth \$5 billion. Is that still objectionable?

GETTING THE DIRT ON DEBRIS

The word "debris" seems to have a large degree of interpretation in the septage industry. For many, it simply means small, scattered pieces of

trash or loose, natural material. For one septage-receiving wastewater treatment facility in Connecticut just recently, debris meant discovering a large fencepost doing its level best to wreck and block the screen and components of its septage acceptance plant.

Raising more than an eyebrow at the uninvited fencepost were the team at Montville's Water Pollution Control Wastewater Treatment Facility (WPCWWTF), whose key responsibility is to protect the ecosystem of the Thames River.

"Can't say that we've seen a fencepost here before," says Scott Farrington, operator II at Montville WPCWWTF, "but in the large volumes of septage we receive, approximately 150,000 gallons per week, we see plenty of interesting objects—and on top of everything else we take in, our treatment equipment is constantly put to the test."

In addition to all the typical challenges of today's wastewater treatment facility—including the curse of those supposedly flushable wet wipes, which are arguably more 'objectionable' than septage, Montville's two-million-gallon capacity also includes industrial-strength wastewater from a major packaging factory via a dedicated 2.4-mile pipeline.

According to the Rockland, Massachusetts-based Maher Corporation, the leading source of water and wastewater treatment products in New England, very few manufacturers have had long-term success in selling in their equipment to meet those highly variable challenges presented by septage.



Angled installation and screen bars of varied heights increase removal efficiency and minimize head-loss.



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Lakeside's Septage Acceptance Plant removes debris and inorganic solids.



The Lakeside Screen is extremely effective in removing rags and plastics.



The rotating rake teeth of Lakeside's Raptor Fine Screen fully penetrate the cylindrical screen bars.

SERIOUSLY RUGGED FOR THE LONG-TERM

"To be frank," says Fred Croy from Maher Corporation, who have provided a wide range of blowers, pumps, pipes, and other equipment for Montville, "as much as we'll always be there for our customers, we don't want to be called back to problems every week, so selling, reliable long-lasting equipment for such a tough application as septage is a must."

He adds, "We are very conscious that the septage going into the town's facility has contained no shortage of crushed granite. This shouldn't get sucked up by the hoses when hauliers make their collections, but inevitably, it happens, making it all the more reason for us to recommend equipment that is seriously rugged, for the long-term."

Almost eighteen years ago, Montville (population 20,000) invested via Maher Corporation in a

Septage Acceptance Plant (SAP) from Lakeside Equipment Corporation. As the SAP name suggests, it is designed to remove debris and inorganic solids from septage tanks (also for grease traps, sludge, leachate, and industrial waste).

Not surprisingly, septage can have a significant impact on plant operations or performance if receiving facilities are not properly designed and managed. It increases plant operation and maintenance costs, with the handling and disposal cost of residuals (sludge, grit, screenings) often showing the largest increase. No such problems at Montville, however, where generating revenue from highly variable septage is a skilled, delicate balancing act, that Scott Farrington and the team led by Superintendent Derek Albertson have become masters at. Keeping the Montville process stable continues to set an excellent example, with state permits met very comfortably for parameters such as total suspended solids (TSS) and biological oxygen demand (BOD5), as well as an extremely effective removal of phosphorus. Up to 75 percent of the treated effluent is recycled for use in a nearby paperboard manufacturer. The remaining clean effluent is discharged to Horton Cove on the Thames River.

Processes aside, septage addition to a wastewater treatment plant can also increase administrative tasks associated with record-keeping and billing of haulers, but ten years ago during a refurbishment—and the need to streamline the septage receiving operation, Montville, again via Maher



Scott Farrington (operator II) at Montville WPCWWTF (left of picture), with Fred Croy from Maher Corporation.

Corporation, introduced a Lakeside Raptor Acceptance Control System (RACS), which was integrated with the SAP to allow authorized haulers to unload septage. This security access station, which includes a data management and accounting system, provides administration capabilities to track and invoice customers.

THE SYSTEM IS INCREDIBLY ROBUST

Montville's Derek Albertson says, "We offer very reasonable rates for septage hauliers, so have taken many more on board in recent years, which is fine so long as we continue to manage this proportionally. We have a constant flow of trucks, but some hauliers think they can bring almost anything in. This is where Lakeside's RACS control system is so effective and flexible. There is a learning curve and skill set required as operators, but the system is incredibly robust; it doesn't need very much maintenance at all. The drivers have to sign in with a code, which provides traceability and frees us up. It also gives hauliers the flexibility to call when they need to, without any unnecessary waiting."

The upgrade at Montville a decade ago also included the addition of a Lakeside Raptor Fine Screen in the influent channel. Unlike the existing, conventional bar screen, this new influent screen benefits from a similar type cylindrical screenings basket as the SAP, with angled installation and screen bars of varied heights to increase removal efficiency and minimize head-loss. The screen's rotating rake teeth fully penetrate the cylindrical screen bars. This prevents plugging and blinding from grease and small debris—thus importantly allowing faster unloading times to generate more revenue. Captured screenings are compacted, dewatered and washed free of most organic materials to approximately 40 percent solids. Volume is reduced by 50 percent and weight by 67 percent; reducing the cost of disposal.

"The Lakeside Screen with quarter-inch apertures has been extremely

effective in removing rags and plastics from our process," adds Albertson.

ONE TECHNOLOGY FOR TWO APPLICATIONS

"We never know quite what we're going to get with septage. Over the years, the Lakeside kit has really taken some hits. People have tried their best to kill this equipment, including with that recent fencepost, but despite being our first line of defence at the intake, the Lakeside SAP and its Raptor Screen have been very dependable, with just routine maintenance required. To say that the unit is robust is a big understatement. The equipment also doesn't take up too much space and is very easy to get at and work on. Overall, the SAP and its screen certainly shields our secondary equipment."

He continues, "The consistency in configuration, which effectively has given us one technology for two

applications, has also been a big benefit to us. What we have now is so much better for the facility, with an automatic screen compared to the old bar rack that had to be cleaned manually. The Lakeside SAP proved so solid that it gave us every confidence to invest in one of their screens." ■

DAN WIDDEL is regional sales manager at Lakeside Equipment Corporation. Lakeside Equipment Corporation is an engineering and manufacturing company concentrating on helping to improve the quality of our water resources. Lakeside started in the spring of 1928 to engineer, develop, and provide water purification systems to municipalities and companies throughout North America. For more information, visit www.lakeside-equipment.com.



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SURGE TRANSIENT PRESSURE MONITORING



Often referred to as surge or water hammer, transient pressures occur when there is a rapid change of fluid velocity in a pipeline as a result of normal and sometimes unplanned operations, such as the start/stop of a pump or the closing of a valve. These pressure variations can be positive or negative and have a magnitude several times the normal or maximum operating pressure, resulting in severe system damage. The term water hammer was coined to describe the audible hammering sound in the pipes as a result of these transient pressures.

While transient pressures are heard audibly in some systems, in other systems transient pressure waves go undetected until something breaks. The duration of a transient event can be anywhere from several hundredths of a second up to a few minutes. It is quite common for operators and engineers to review pressure records after suspecting a pressure problem in search of "the event."

Typical pressure measurement systems often capture small ticks in pressure. When reviewing pressure records, these small ticks are often deemed acceptable (perhaps even unrelated) to the event in question, especially if they are within design allowances. However, what remains unseen is the true degree of pressure fluctuations, which

can only be captured with a high-speed data recorder such as Blacoh's patented SurgeWave™ Transient Monitoring System.

The SurgeWave system allows pipeline operators and maintenance engineers to accurately detect and record transient pressure events occurring in water, wastewater, and petroleum/chemical pipelines. It is unique in that it employs a system of dynamic pressure transducers and digital technology to monitor pipelines for indefinite periods of time. When a transient such as a pressure spike or water hammer event is detected, the system activates a high-speed data recorder to record the event up to 100 times per second. The granularity of this data allows users to see broader and more frequent pressure fluctuations that normal pressure measurement devices cannot provide. The engineering breakthrough that is SurgeWave allows designers, engineers, manufacturers, and operators the ability to assess the overall performance of a pipeline, pumping plant, or petroleum refinery using non-destructive, real-time sensors and hand-held monitoring equipment. With it, users are able to capture true transient pressure fluctuations, address pressure loads immediately, and, ultimately, better protect their pipeline systems. ■

For more information, visit

WWW.BLACOH.COM

YASKAWA AMERICA

FP605 INDUSTRIAL FAN AND PUMP DRIVE

Here for the long haul and helping to contribute to a healthy and sustainable environment, the FP605 is an easy to install and configure industrial fan and pump drive. It is designed for countless applications to reduce energy use, including centrifugal compressors, fans, pumps, and process control in industries such as material handling, food and beverage, chemical, rubber and plastics, textile and printing. The FP605 builds on the successful legacy established by its predecessor, the P1000 AC Drive. Like Yaskawa's GA800 and GA500, the FP605 uses flexibility, sustainability, and ease of use to make the complicated simple. For more information, visit www.yaskawa.com/fp605.



GORMAN-RUPP

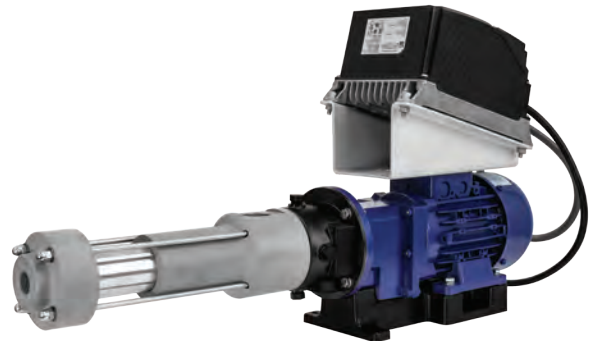
ERADICATOR PLUS

For liquids containing trash bags, wipes, mop heads, hair, industrial by-products, and agricultural wastes, the Eradicator Plus is ideal when cutting and tearing of organic solids entering the pump is required. Based on the same principles of the Eradicator Solids Management System, Eradicator Plus models are the most aggressive in the Super T Series product lineup. For new Super T Series pump installations, complete units are available in cast iron construction. Eradicator Plus upgrade kits are available for Super T Series pumps currently installed in the field. For more information, visit www.grpumps.com.

SEEPEX

MDR PROGRESSIVE CAVITY METERING PUMP

The Seepex MDR range progressive cavity pump is a metering pump that can withstand the harshest chemicals. Due to an external GA seal arrangement and engineered composite seal housing, lantern, and rotating unit, the only metallic part in contact with the conveyed product is the rotor. This design allows for broad chemical compatibility, increased performance, and decreased maintenance. It also features a patented joint design that performs as a constant velocity joint, reducing pulsation to levels only detectable by laboratory equipment. For more information, visit www.seepex.com.



MUELLER WATER PRODUCTS

HYMAX® PRO DEDICATED SIZE COUPLING

Mueller's Hymax Pro Dedicated Size Coupling is the newest addition to the Hymax repair and installation portfolio for the North American market. This line of dedicated couplings, also known as flexible couplings, is engineered for new construction projects to provide an easy and safe means of joining same-size plain end pipes without the need for welding and/or special pipe fittings. The 304SS stainless-steel fusion-bonded epoxy coated hardware and EPDM gasket are built into the standard product specifications of this line without additional cost. For more information, visit www.hymaxusa.com/products-main/hymaxpro-dedicated-couplings.

THERE'S NO SUCH THING AS "WASTE" WATER, ONLY WASTED WATER

The WateReuse Association's Pat Sinicropi says, for recycled water, the future is now



For over three decades, the WateReuse Association has been dedicated to advancing laws, policy, funding, and public acceptance of recycled water. WateReuse represents a coalition of utilities that recycle water, businesses that support the development of recycled water projects, and consumers of recycled water. On a recent episode

of MPT's podcast, The Efficiency Point, the association's executive director, Pat Sinicropi, shared her vision of the organization's mission and the water industry's future.

MPT: *How does the WateReuse Association's mission advocate for expanding the use of recycled water?*

PAT SINICROPI: Our mission is really to start a movement, a national movement, toward water recycling, to develop public acceptance across the country and across the many regions where water resource challenges are putting pressure on rate payers and regions and emphasize ways that water recycling can help.

So our mission is pretty expansive, but we think really in many ways, water recycling is the future of water resource management and our mission is to expand its adoption. We do that through advocating for policies and funding at the federal level and our sections—we have several state sections—who do the work at the state level, advocating

for policies and funding to facilitate the adoption of water recycling practices locally.

MPT: *More people—both in industry and municipalities—are accepting the notion of water as a finite resource. What are some ways water reuse can ease the pressure on our available water supply?*

PAT SINICROPI: First of all, don't waste water. Often you'll hear the phrase wastewater, but there's no such thing as "waste" water—it's only wasted water. And water recycling attempts to use every reuse, every drop of water, for a beneficial purpose, so whether you are along the coast or in the middle of the country. If you are facing supply challenges, water recycling allows you to ensure that you're getting the most out of the water you're using. Not only once, but twice and three times, so we really try not to waste water.

MPT: *Which industries do you see reaping the most benefits from water reuse today? And where is there the biggest potential for growth?*

PAT SINICROPI: We're seeing a lot of growth in the tech sector, specifically in data centers' use of recycled water, which they use for cooling. It's easier to recycle water as a coolant as it doesn't need to be repurposed as drinking water quality water for cooling. Some of these facilities are enormous and generate a great deal of heat, so it takes a lot to keep those data centers cool and running, and we're seeing a lot of growth in the use of water of recycled water. ■



To listen to an extended version of this interview, be sure to subscribe to MPT's podcast, The Efficiency Point.



Founder Rod Mersino circa 1997

25TH ANNIVERSARY

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Since Global Pump's inception in 1997, the product line has developed out of the need for a more rugged, reliable, and efficient pump. The designs are tested and proven in the field - not only by our parent company Mersino Dewatering but also by valued end-users and rental customers from around the world.

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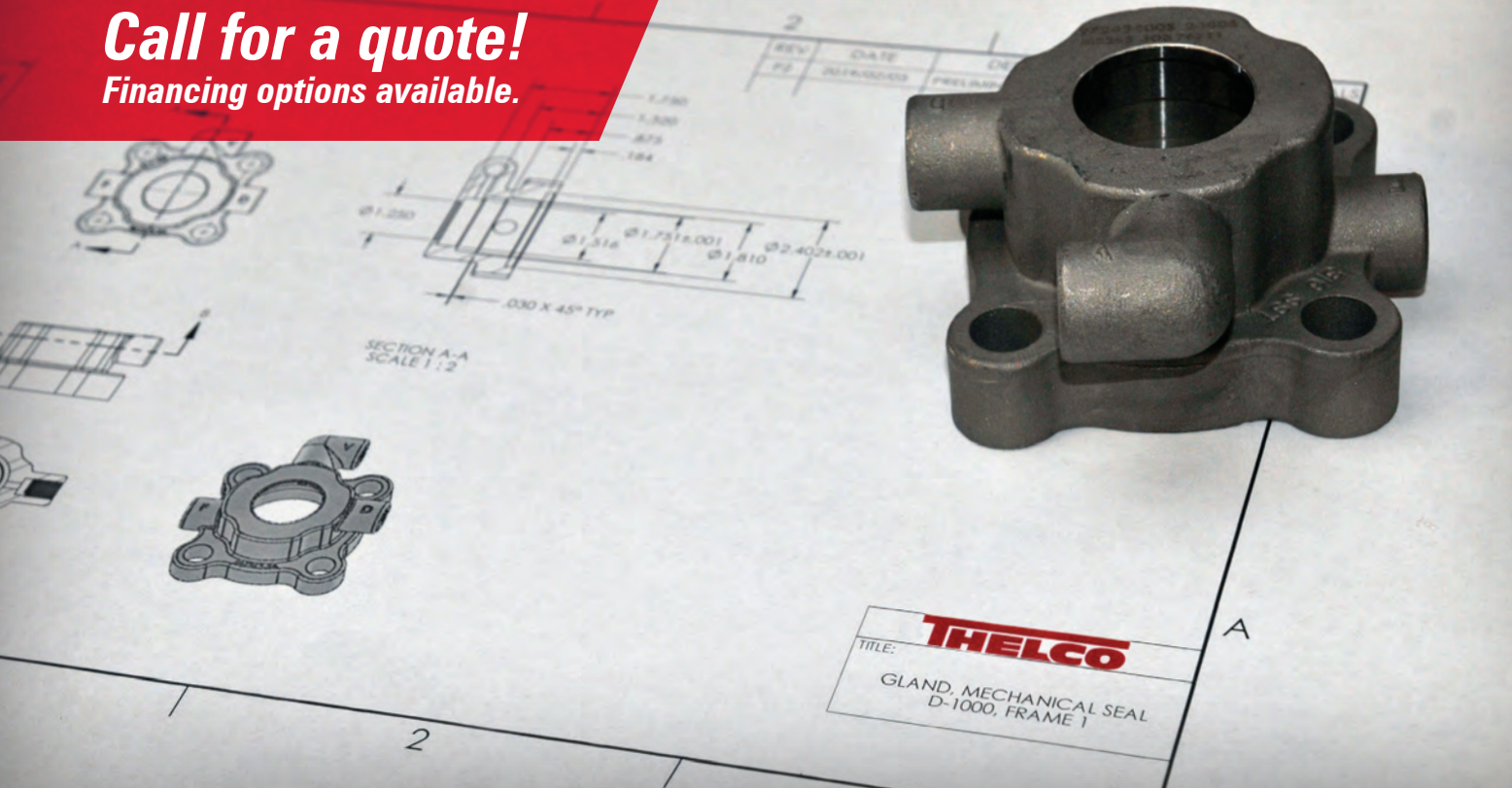
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